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THE MELANOSTOMINI OF THE NEOTROPICAL REGION (DIPTERA, SYRPHIDAE)

BY C. L. FLUKE[1]

There are several genera and subgenera belonging to this tribe in the Neotropical region. Numerous species occur in the genera *Melanostoma* and *Rhysops*, especially in the higher altitudes of the Andes. This review is based upon several collections, the most important by F. Martin Brown from Ecuador[2] and by Fritz Plaumann from southern Brazil. Dr. C. H. Curran of the American Museum has lent specimens of the Williston collection from Chapada and Mexico, and Dr. F. M. Hull of the University of Mississippi has sent me his material for study. Thanks are due to all these gentlemen for their willing and generous help. Types of the new species are deposited in the American Museum of Natural History.

Tribe **Melanostomini**

The Melanostomini belong to the subfamily Syrphinae. Face entirely black, although the slopes may often be covered with white or yellow pollen-like pubescence, interhumeral region without pile, discal cross vein (r-m) well before the middle of the discal cell, squamae and plumule well developed, wings generally hyaline or tinged brownish or with faint clouds at cross veins or at the apex.

TABLE OF GENERA

1. Face narrow, receding; not at all produced below; abdomen broad and oval...........*Xanthandrus* Verrall
   Face broad, either produced forward or perpendicular, not at all receding; abdomen usually narrow..........2
2. Small, entirely black; face extending well forward with a prominent tubercle; arista microscopically pubescent...*Tuberculanostoma* Fluke
   Mostly larger and with yellow markings on abdomen or legs; face less produced; arista usually bare.....3
3. Antennae elongate, the second segment longer than broad, first segment also elongate; legs of male without peculiar hairs or strong bristles....... ....*Rhysops* Williston
   Antennae shorter, the second segment broader than long, first segment also short..........................4
4. Genitalia of male very large with elongate cerci and styles; third segment of antennae round...... ....*Melanostoma* subgenus *Talahua*, new subgenus
   Genitalia normal in size.............5
5. Face produced forward, rippled or strongly punctate; front tibiae of male with strong black bristles..... ....*Melanostoma* subgenus *Carposcalis* Enderlein
   Front tibiae of male without strong bristles; face may or may not be produced, seldom punctate......... ....*Melanostoma* Schiner

It is impossible to draw sharp lines of distinction for all these groups, but I believe they are generally natural. A few others occur where it might be desirable to split off at least subgenera. I refer particularly to *Rhysops lopesi*, new species, with its very elongate antennae and smooth face; to *Melanostoma palliatum*, new species, with its round antennae and reddish pleura; and to *Melanostoma rex*, new species, with its peculiar carinate and produced face. Perhaps *Carposcalis* should not be reduced to subgeneric rank (certainly Enderlein did not intend that it should be), but I am unsure of its status since he used *stegnum* Say as a genotype when he misidentified the species.

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[1] University of Wisconsin, Madison, Wisconsin.

[2] Brown, F. Martin, 1941, A gazetteer of entomological stations in Ecuador. Ann. Ent. Soc. Amer., vol. 34, pp. 809-851.

Rhysops and *Melanostoma* are difficult to separate, so the keys for the species of each should be checked if there is any doubt in identification.

Xanthandrus[1] and *Tuberculanostoma*[2] are not treated in this paper as they have already been dealt with by me.

RHYSOPS WILLISTON

WILLISTON, 1907, Jour. New York Ent. Soc., vol. 15, p. 2.

Braziliana CURRAN, 1925, Ann. Mag. Nat. Hist., ser. 9, vol. 16, p. 252; 1937, Amer. Mus. Novitates, no. 926, p. 1.

Melanostoma-like flies with elongate antennae, the second segment longer than broad (side view); the first segment elongate, usually as long as, and sometimes much longer than, the third; face often with transverse grooves, lower slopes with a flattened rugose area; legs without peculiar hairs or bristles; scutellum of female usually with two setulose hairs; notopleura generally with a prominent tubercle.

GENOTYPE: *R. rugosonasus* Williston.

The fine hairs on the sides of the face are long enough to be considered pubescence, but because of general usage the term pollen is employed in this paper.

Williston erected *Rhysops* for those species of *Melanostoma* having elongate antennae such as "*scitulum*, *rugosonasus*, and *melanocerum*, etc." He also included the character of the transverse ridges and depressions on the face which are so characteristic of *rugosonasus*. Later Curran erected *Braziliana* for the species *longicornis*, which does have elongate antennae but lacks definite transverse facial grooves.

If Williston had selected this last-named species as typical of his new genus, his choice would have been better than that of Coquillett, who later picked *rugosonasus* as the genotype, the second named of three species listed. The grooves have great variation, all the way from several, as in the genotype, to one or two or even none, as in *lopesi* described in this paper. The length of the antennae varies also, being decidedly short in the genotype but very elongate in *longicornis* and *lopesi*. I agree with Curran that "the dividing line is not as well marked as one would like to have it." There are several species which are difficult to separate from *Melanostoma* based on the antennal characters; even the one used by Curran, namely, "second segment longer than wide," is sometimes difficult to interpret. This character, however, places the genus on a firmer, although still weak, foundation.

TABLE OF SPECIES

(The species *melanocera* Williston from Costa Rica is not included.)

1. First antennal segment as long as or longer than the second and third combined......................2
   First segment definitely shorter than the other two combined..........6
2. Face with numerous shallow transverse grooves above the tubercle; wings with two short, narrow, transverse brown bands near the middle on the anterior half (Mexico)...... ....*crenulata* Williston
   Face at most with one groove above the tubercle; wings without transverse bands....................3
3. Sides of face evenly white pubescent; mesonotum highly polished (Brazil) ....*lopesi*, new species
   Sides of face punctate; mesonotum at least partly pollinose, usually vittate 4
4. Abdomen with two pairs of large triangular, yellow spots (Colombia).. ....*thiemei* Enderlein
   Abdomen with one pair of yellow spots 5
5. Anterior legs wholly yellowish (Peru) ....*peruviana* Shannon
   Anterior femora black on basal third or more...................(*vittithorax* Hull) *longicornis* Williston
6. Pubescence of face punctate........7
   Pubescence not punctate...........8
7. Abdomen with oblique oval spots, one pair on the male, two pairs on the female; front femora yellow (Brazil)..........*fastigata*, new species

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[1] 1937, Amer. Mus. Novitates, no. 941, p. 6.

[2] 1943, Ann. Ent. Soc. Amer., vol. 36, p. 425.

Abdomen with two pairs of large triangular spots covered with gray pollen; front femora brownish on basal half.........*columbiana* Enderlein

8. Face above the tubercle with at least five transverse grooves across the middle; abdominal spots metallic (Mexico).....*rugosonasus* Williston
Face with no more than four and usually with two shallow grooves or less..........................9

9. Four front femora black or at least mostly dark brown.............10
Four front femora yellow or orange yellow........................14

10. Hind femora yellow on the basal fourth, the four front femora broadly yellow apically; abdominal spots lineate (Brazil)..*lineata* Fluke
At most only the apex or narrow base yellow on the hind femora......11

11. Antennae entirely black; small black species with prominent tubercle (Ecuador).......*opaca*, new species
Antennae reddish, at least below on the third segment..............12

12. Front tibiae largely black or brown.13
Front tibiae yellow...............14

13. Abdomen black, the female with yellowish spots on the basal corners of second tergite (Brazil)...........................*nigrans*, new species
Abdomen with large yellow spots, two pairs on the male, three on the female (Brazil)...............................*columella*, new species

14. Small species; hind femora yellow with a black apical ring.........15
Larger species (7 to 10 mm.); hind femora at least one-half black, either basally or apically........16

15. Spots on the third and fourth tergite quadrate; hind tibiae mostly brownish (Dominican Republic).................*quadrimaculata* Hull
Spots on these tergites triangular; hind tibiae mostly yellow (Brazil).................*minuscula*, new species

16. Hind femora black, only the narrow base yellow; yellow spots on the third tergite separated by more than the width of spots.........17
Hind femora at least one-fourth yellow basally...................19

17. Facial pubescence golden and very thick, pile of front yellow; abdomen with three pairs of yellow spots (male) (Ecuador)........................*festiva*, new species
Facial pile thinner and more whitish, pile of front black; abdomen with two pairs of yellow spots........18

18. Front tarsi wholly yellow (Brazil)....................*scitula* Williston
Front tarsi dark (Mexico)..........................*catabomba* Williston

19. Mesonotum reticulate (Brazil).............................*lanei* Fluke
Mesonotum pollinose.............20

20. Yellow spots on the abdomen vittate; front of female below ocelli with a complete transverse black fascia (Brazil).............*pollinosa* Hull
Yellow spots on abdomen either triangular or oblique; front of female with two round opaque brown spots 21

21. Sides of face lightly punctate and rippled; one pair of oblique discal spots (third tergite) on male, an additional similar pair (second tergite) on female (Brazil)......................*fastigata*, new species
Pollen on the sides of the face neither punctate nor rippled; spots on the third and fourth tergites triangular and located on the basal corners (Brazil).............*currani* Fluke

Rhysops longicornis (Williston)

Figure 1

Melanostoma longicornis Williston, 1888, Trans. Amer. Ent. Soc., vol. 15, p. 263.

Braziliana vittithorax Hull, 1937, Jour. Washington Acad. Sci., vol. 27, p. 176.

This species is easily recognized by the punctate face, low tubercle, first segment of antenna equal to the second and third together, and a pair of yellow spots on the third tergite. There are two or three quite faint depressions above the tubercle and the notopleural tubercle is very prominent. Facial pollen white. Length, 7 to 9 mm.

Type from Chapada, Brazil, in the American Museum. Material reviewed:

two of the original types; one male and five females, Nova Teutonia, Brazil, September and October, 1936 and 1937 (Fritz Plaumann); a pair from São Paulo, Brazil, 1939 (Barretta): and a female, Puyo, Oriente, Ecuador, 3000 meters, December, 1938 (F. M. Brown). Curran has recorded it from Colombia.

Rhysops fastigata, new species

Figures 4, 37

Related to *longicornis* Williston and *peruviana* Shannon. Face less punctate; first segment of antennae shorter, a little longer than the third but shorter than the second and third together; four front femora entirely yellow; abdomen with one pair of oblique yellow spots on the male, two on the female. Length, 8 mm.

MALE: Face shining black with coppery reflections along the sides, mid-stripe without pollen; three faint transverse grooves, two just above the tubercle and a third near the antennae; pollen on the sides of the face white, lightly punctate, and with a rather large triangular bare spot above; the facial pollen is also somewhat ripple-like; a heavy white patch next to the eyes which connects narrowly to a brown pollinose spot in the ocular corners of the front; this spot of pollen extends toward the antennae as a fine point and is present in a longitudinal groove. Pile of face and cheeks whitish, of the front black. Occiput heavily pollinose, the cheeks almost bare. Ocellar triangle blue-black, the pile sparse and black. Antennae yellow, dark on the apex and upper half of the third segment; first segment curved, longer than the third. shorter than the second and third together.

Thorax shining greenish black, brownish pollinose anteriorly on the mesonotum and with two dark brown vittae, which begin at the transverse suture and narrow to obscurity about halfway to the scutellum; pile of the mesonotum yellow. Pleura mostly shining, pollinose on the mesopleura and hypopleura, the pile long, yellow with black tips, the underhanging hairs long.

Legs yellow; black on the apical two-thirds of the hind femora, all the hind tibiae, and the apical two or three segments of the tarsi; the pile yellow on the four front femora and tibiae and on the basal and outer sides of the hind femora, the rest black.

Wings hyaline, faint clouds at the cross veins; the stigma yellow; squamae black, the basal corner yellow; plumule white; halteres orange yellow.

Abdomen opaque black, shining along the sides and on the fourth and following tergites, the pile yellow along the sides; a pair of oblique yellow spots on the third tergite which reach from the base to the apical third.

FEMALE: Front with two spots of brown pollen just below the shining blue ocellar triangle; between the two spots is a narrow brown pollinose streak reaching to the shining arc above the antennae. Mesonotum with three brown vittae, the two on the sides reaching almost to the scutellum and the median one very slender and reaching from the fore to the rear margin. Abdomen with two pairs of spots, an additional isolated one on the second tergite, more slender than those on the third tergite. Squamae not so dark, only the narrow edge black.

TYPE MATERIAL: Holotype, male, Nova Teutonia, Brazil, July 4, 1937 (Fritz Plaumann). Allotype, female, same locality, October 17, 1936.

The color of the legs suggests that this species is the same as *peruviana* Shannon, which I have not seen. The antennae, however, are not so long as described by Shannon, and the wings are not entirely brownish; only the cross veins are clouded.

Rhysops peruviana (Shannon)

Braziliana peruviana SHANNON, 1927, Proc. U. S. Natl. Mus., vol. 70, p. 7.

This species has not been seen by me. It was described from a single male, which is undoubtedly closely related to *longicornis* Williston, differing principally in the color of the front legs, which are all yellow except the tarsi. The wings are also entirely brownish. The first segment of the antennae is stated to be more than four times as long as broad, which is my understanding of the length of the antennae of *longicornis*. The first segment of the antennae of *fastigata*, new species, very closely related to *peruviana*, is no more than three times as long as broad even if measured by the longer under side.

Rhysops thiemei (Enderlein)

Braziliana thiemei Enderlein, 1937, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 201.

This species is related to *longicornis* Williston, having a punctate face and long antennae, the first segment five times as long as wide. Apparently it differs from *longicornis* only in the presence of two pairs of yellow abdominal spots. The antennae are brownish yellow, the third segment brown. The front of the female has two large, dull, velvety black, round spots, which are united behind by a dull gray black band. The legs are golden yellowish, hind tibiae and apex of hind femora (on the male second and third pairs) one-third brown; in this respect it resembles *peruviana* Shannon. It was described from two males and three females from Colombia. I have not been able to recognize it among my specimens.

Rhysops columbiana (Enderlein)

Braziliana columbiana Enderlein, 1937, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 202.

I have been unable to recognize this species from Enderlein's brief description. It is related to *longicornis*, a species with punctate spots on the sides of the face, but the antennae are shorter; the first and third segments apparently of about equal length, being three to three and one-half times as long as broad. The front femora brownish on the basal half, the mid-femora all brown except the tip, and the hind femora dark brown except the basal sixth. There are two pairs of large yellow spots on the abdomen which are covered with gray pollen, and in this respect they differ from *fastigata*, new species. The front femora of the latter species are also entirely yellow, brown on the basal half of *columbiana*.

Rhysops catabomba (Williston)

Figure 2

Melanostoma catabombum Williston, 1891, Biologia Centrali-Americana, Insecta, Diptera, vol. 3, p. 12.

First segment of the antennae about the same length as the third; face without distinct grooves, only two very shallow and wide depressions; dorsum of thorax brown pollinose; abdomen of male with two pairs of oval yellow spots. Length, 10 mm.

Male: Pollen of the face whitish to yellowish, thinner down the middle of the sides, the mid-stripe broad and shining, pile dark on the sides near the antennae becoming paler below; oral edge shining. Front with yellowish to brownish pollen, with a rather deep shining arc just above the widely separated antennae, pile black. Antennae yellow to reddish, the third segment brown above and on the apical half. Ocellar and upper occipital pile blackish.

Thorax bronze, considerably shining but with brown pollen, pile yellow to light brown.

Legs yellow to reddish, the middle femora darkened on the basal half, the hind tibiae and hind femora and all the tarsi reddish brown to brown, hind metatarsi yellow.

Wings dilutely reddish, darker towards the tip; squamae yellow, the edge and fringe brown; halteres yellow.

Abdomen black, shining along the sides, widest at the apex of the third segment; with a pair of basal oblique yellow oval spots on the third and fourth tergites. These spots are widely separated but in the specimen before me do not reach quite to the sides. Pile of the abdomen yellowish brown.

A male specimen was studied from the material on which the original description was based, collected at Guerrero, Mexico, 7000 feet, by H. H. Smith. I have not seen the female.

Rhysops crenulata (Williston)

Figure 3

Melanostoma crenulatum Williston, 1891, Biologia Centrali-Americana, Insecta, Diptera, vol. 3, p. 12.

First segment of the antennae longer than the last two combined; face with seven or eight shallow transverse depressions. Length, 7 to 8 mm.

Female: Face highly polished, the pollen white and confined to a narrow stripe on each side from the antennae to close to the oral margin, connecting by a broader stripe to the eye and thence along the eye to a triangle opposite the lowest depression of the face, then connecting with the white triangles on the lower front: pile of the face short and white. Front brownish opaque below the ocellar triangle and above the depression, bordered above by a very narrow whitish pollinose band; white pollinose band across depression not interrupted, the ground color bluish. Ocellar and frontal pile short, black. Upper occiput shining blue-black, lower occiput heavily coated with white pollen and pile.

All the femora black, their apices yellow; four front tibiae yellow, the posterior pair dark with the basal third yellow; tarsi yellow, apical three segments darkened. Anterior cross vein clouded, also smaller clouds at other cross veins.

I have had the privilege of studying two females of the original lot from Mexico, collected by H. H. Smith. Williston's description mentions only three or four transverse depressions on the face, but the females I have seen easily show seven or eight depressions, stronger in one specimen than in the other. I know of no other species that *crenulata* might be confused with except possibly *melanocera*. I have not seen this latter species but Williston's description is quite distinct in regard to the antennae, "third joint oval, about as long as the first two joints together."

Rhysops lopesi, new species

Figure 5

Antennae elongate, the first segment nearly four times as long as the second and about twice as long as the third. Face with a low tubercle and with no prominent depressions above, pile and pollen white. Mesonotum shining black without pollen. Length, 7 to 8 mm.

FEMALE: Head shining black with white pile except for some brownish hairs on the upper half of the front. Face with a very low elongate tubercle, only slightly concave below the antennae, with no distinct transverse depressions, although there are two very faint depressed lines immediately above the tubercle. Face entirely covered with white pollen except for a median vitta, which is broadest over the tubercle; oral tips somewhat produced below; a shining area between the eyes and oral tips; cheeks heavily coated with white pollen and white pile. Front highly polished with coppery reflections, extremely wide, the ocelli on a slightly raised triangle, the pile white below, more brownish in a wide band across the vertex; brown pile also appears on the rather wide upper part of the occiput, the rest of the occiput with white pollen and pile. Antennae inserted on a raised base, the first segment extremely long, yellowish in color with black pile; second segment dark brown, about one-fourth as long as the first; the third black and about one-half as long as the first; arista thick, about as long as the third segment, yellow at the base and dark on the apical third. On each side of the tubercle is a large, rectangular, flat, slightly rugose area, although the wrinkles show only on the upper edge.

Thorax shining, with the mesonotum highly polished and with fine short white pile; the scutellum also highly polished, but with two rugose depressions near the tip, the pile entirely white. Pleura with a slightly bluish cast, covered with white pollen and rather long white pile. Notopleura with only a slight indication of a tubercle.

Legs yellow, the femora and a broad ring on the hind tibiae reddish brown; pile everywhere yellow, except a few black hairs dorsally on the last three segments of the hind tarsi.

Wings hyaline, stigma diluted yellow. Squamae yellow with white fringe, plumule white, halteres yellowish white, the stalks slightly darker.

Abdomen everywhere polished with dark brown to black reflections, no evidence of yellow spots anywhere, the pile all white except for some darker hairs down the middle of the fourth tergite.

TYPE MATERIAL: Holotype, female, S. Jose dos Campos, Brazil, X-933 [this probably refers to the date October 9, 1933], (H. S. Lopes). Paratype: female, same data.

Rhysops rugosonasus (Williston)

Figure 6

Melanostoma rugosonasus Williston, 1891, Biologia Centrali-Americana, Insecta, Diptera, vol. 3, p. 3.

Rhysops rugonasus Williston, 1907, Jour. New York Ent. Soc., vol. 15, p. 2.

Rhysops rugonasus Coquillett, 1910, Proc. U. S. Natl. Mus., vol. 37, p. 13.

Male: A dark species with a flat face, which has about six or seven ridges separated by shallow depressions; a large oval median vitta is shining, but the rest of the face is whitish pollinose. Antennae with the first and second segments together a little longer than the third. The notopleural tubercle very prominent. Abdomen elongate, opaque black, more shining along the sides and broadly on the anterior corners of the third and fourth tergites. There are no peculiar hairs on the legs, although the pile is quite long on the outer sides of the femora, and there are about one-half dozen longer hairs on the outer sides of the hind tibiae.

The female is quite similar except that the pile of the legs is much briefer, with very few long hairs on the femora and none on the tibiae. Length, 10 to 11 mm.

Williston mentions only five well-marked transverse grooves. In examining 10 specimens from Mexico City, I have found that the number of depressions vary, but there are usually six or seven. The depressions extend almost to the base of the antennae.

The original spelling of this species is *rugosonasus*. Williston misspelled it *rugonasus* when erecting the genus *Rhysops*, and it has often been used thus since.

Type from Mexico. Specimens reviewed: nine males and one female, Mexico City, 10,000 feet, July, 1936 (H. G. Meyer).

Rhysops lineata (Fluke)

Figure 7

Melanostoma lineata Fluke, 1937, Amer. Mus. Novitates, no. 941, p. 9.

A shining black to aeneous species with relatively short antennae, two faint depressions above the tubercle, highly polished mesonotum with two faint vittae anteriorly, and linear yellow vittae on the abdomen. There is an error in the original description regarding the antennae; it should read "first segment only very little longer than the second, which is longer than wide."

Type from Nova Teutonia, Brazil, in the American Museum.

Rhysops scitula (Williston)

Figures 43, 54

Melanostoma scitulum Williston, 1888, Trans. Amer. Ent. Soc., vol. 15, p. 264.

"Male: Length 7 mm. Allied to *M. longicornis*. Antennae less elongate, the three joints of nearly equal length, the third not twice as long as wide. Face on the sides with a slender stripe and spot of pollen, not punctulate. Abdomen narrow, of nearly equal width throughout; fourth segment also with two yellow strigulae. Four front tarsi wholly yellow. Wings hyaline, an elongate stigmatic spot and narrow clouds on the cross-veins brown.

"Two specimens, Chapada."

I have been unable to recognize this species among the numerous specimens recently received from southern Brazil, although one of the type specimens, a male, is before me, but it is headless and appears somewhat teneral. The clouding of the anterior cross vein (r-m) is quite characteristic, but it is not entirely reliable as other species often have a slight browning along this vein. The four front femora appear only pale brown on the basal half but may be quite dark on fully matured specimens.

Mesonotum mostly shining, with two faint whitish pollinose vittae on the anterior half, the pile of the thorax entirely pale. The four front tibiae and tarsi and the hind metatarsi are yellow; the hind tibiae and femora are mostly dark brown, yellow at the knees, and narrowly yellow at the base of the femora.

Abdomen with a basal pair of elongate yellow spots on the third tergite reaching the apical third, a similar smaller pair on the fourth tergite separated from the base of the tergite and occupying one-half its length.

Williston compares his *crenulata* with *scitula*, remarking that the facial grooves are quite similar.

Rhysops nigrans, new species

Figure 8

Face perpendicular without prominent grooves above the tubercle, femora and tarsi black, abdomen black with small yellow to red spots on the basal corners of the second tergite. Length, 8 to 9 mm.

FEMALE: Face nearly straight, the tubercle low with two very faint transverse depressions above: white pollinose, shining on a broad mid-stripe, around the oral edges, a narrow band above the cheeks from the eyes to the oral edge, an arc above the antennae, and thinly pollinose from the antennae down the slopes of the face almost to the flat area opposite the tubercle; the pile white. Front dark with a broad opaque band just below the ocelli, gradually fading into white pollen in the depression, the pile black. Ocellar triangle semi-shining black with black pile, occiput whitish pollinose and white pilose on lower two-thirds, black pilose on upper third. Antennae reaching to the tubercle, the first segment shorter than the third, the third a little shorter than the first two together, reddish yellow but darker on the outer sides and above on the third segment.

Thorax black, the mesonotum semi-opaque on the disc, more shining along the sides, two median white pollinose vittae on the anterior half, the pile whitish and very short, dark brown along the sides beyond the suture; pleura lightly white pollinose, the pile all white. Notopleural tubercle prominent. Scutellum blue-black, shining, slightly rugose, the pile short and pale with two long black hairs at the apex; the fringe thin and white.

Legs dark brown to black, the basal one-third of the tibiae and the apex of the femora reddish yellow, pile all black, even the mat under the hind metatarsi.

Wings tinged with brown, the stigma elongate brown, very light clouds at the fork of the second and third veins and on the anterior cross vein. Squamae yellowish, the border and fringe brown; plumule white; halteres yellow.

Abdomen semi-shining black, yellowish red triangles in the basal corners of second tergite reaching over the sides and half the length of the segment.

MALE: Very similar, the pollen of the frontal triangle whitish along the eyes, brownish elsewhere; the pile of the mesonotum longer and brownish yellow; pile of the scutellum longer and more yellowish, blackish on the rim. Abdomen more opaque and without definite yellow spots, pile longer along the sides, short, black, and appressed on the discs of the tergites.

TYPE MATERIAL: Holotype, female, Nova Teutonia, Brazil, July 1, 1936 (Fritz Plaumann). Allotype, male, same locality, July 20, 1937. Paratypes: 10 females, same locality, June and July, 1936 and 1937; one male, Santa Catharina, Brazil, January 21, 1929.

Rhysops columella, new species

Figures 9, 39, 40

Closely related to *nigrans*, differs in its slightly larger size, more wrinkled face, and prominent yellow markings on the abdomen. Length, 10 to 11 mm.

MALE: Head shining black, the slopes of the face whitish pollinose, which thins out down the middle from the antennae to the flattened rugose area opposite the tubercle; three or four faint depressions above the tubercle, the pile black on the sides. Front more brownish pollinose except for the highly roughened arc above the antennae, pile black. Ocellar triangle black with black pile, occipital pile black above, yellow below.

Mesonotum from a top view semi-shining aeneous, viewed from behind with two whitish vittae on the anterior half, viewed from the side brownish pollinose; the pile brownish. Pleura shining black with a light coating of white to brownish pollen, the pile yellowish; mesopleura with brownish metallic reflections. Scutellum shining, slightly rugose on the apical half, the pile long and yellow, fringe long and yellow.

Legs reddish brown to black, the four front tibiae yellowish on the basal fourth to third, no sharp demarcation; pile inconspicuous, mostly black.

Wings brownish hyaline, the stigma brown. Squamae brownish yellow, plumule white, halteres yellow.

Abdomen black; first tergite shining; second opaque with a pair of slender yellow vittae on the sides free from the base and reaching the apical sixth; third opaque black in the middle but with a pair of large, nearly rectangular, yellow spots, free from the shiny sides and reaching the apical third of the segment, the apical ends of the spots rounded, basal ends widen before reaching the base; fourth tergite with similar but smaller spots, the segment nearly all shining; fifth tergite shining; genitalia shining black with black pile. Pile of the sides longer and more yellowish anteriorly.

FEMALE: Facial grooves four in number and definite, pile of the face white. Front with a broad opaque black fascia just below the ocelli, the depression whitish pollinose, pile black.

Pile of the thorax very short, the scutellum with two apical setulose hairs. Abdominal spots narrower and more isolated than on the male, those on the second tergite wider, those on the fourth tergite reaching only halfway.

TYPE MATERIAL: Holotype, male, Nova Teutonia, Brazil, June 10, 1937 (Fritz Plaumann). Allotype, female, Nova Friburgo, E. Dorio, Brazil, April 4, 1937 (H. S. Lopes). Paratypes: male, October 10, 1936, and female, July 6, 1936, same locality as holotype; male, São Vicente, Brazil, April 22, 1934; female, same data as allotype.

I believe these females belong with the males. There is some variation in ground color on the females (one with blue reflections on the head and scutellum) and in the extent of the maculation of the abdomen of both sexes.

Rhysops currani Fluke

Figure 10

FLUKE, 1937, Amer. Mus. Novitates, no. 941, p. 8.

Face with three faint transverse depressions; first segment of antennae longer than the second but shorter than the third, the third shorter than the first two combined. The shining mid-stripe of the face bisected above by a median dash of pollen which reaches to the middle depression. The legs are mostly yellow, the four front tibiae and femora yellow, but with a darker apical smudge on the outside of the mid-femora on the male; basal half of the hind femora yellow, the apical half except tip shining black. Yellow triangular spots on the basal corners of third and fourth tergites. Length, 9 mm.

Types from southern Brazil.

Rhysops quadrimaculata Hull

Figures 12, 41

HULL, 1944, Psyche, vol. 51, p. 28.

Very similar to *currani* Fluke, but the abdominal spots are quadrate instead of triangular. In addition, there is an extension of the rugose area on the sides of the face opposite the two middle depressions as well as opposite the tubercle. Pollen of face in narrow bands, from antennae to oral edge, with another fork going to eyes and meeting first band broadly on the lower rugose area, upper rugose area bare of pollen. First segment of the antennae very little shorter than the third.

Legs yellow; the hind tibiae obscurely dark except the indefinite base, the apical third or little more of the hind femora, the hind metatarsi and the apical third or a little more of the hind femora, the hind metatarsi and the two or three apical segments of the other tarsi dark brown.

Abdomen mostly opaque black, more shining on the sides with a pair of quadrate yellow spots in the basal outside corners of third and fourth tergites, slightly wider on the outside and reaching nearly to the apical half.

This description made from a paratype, male, Loma Vieja, S. Constanza, Dominican Republic, 6000 feet, August, 1938.

Rhysops pollinosa Hull

Figure 11

HULL, 1942, Jour. Kansas Ent. Soc., vol. 15, p. 10.

Characterized by the lineate spots on the abdomen, four faint transverse grooves on the face, yellow to orange anterior femora and brownish pollinose mesonotum with the usual two yellowish median vittae on the anterior half. The antennae on the holotype (female) are missing. Since it appears to be related to *lineata* Fluke, differing principally in the color of the legs, the antennae will probably be found to be quite similar. Length, 9 mm.

Known only by the holotype, female, collected at São Paulo, Brazil, November, 1940 (J. Lane). Through the courtesy of Dr. Hull I have had the privilege of studying this specimen.

Rhysops lanei (Fluke)

Figure 14

Melanostoma lanei Fluke, 1936, Jour. Kansas Ent. Soc., vol. 9, p. 61.

Rhysops lachrymellea Hull, 1942, Jour. Kansas Ent. Soc., vol. 15, p. 10.

A small species with a low tubercle, one depression above the tubercle, the first and third segments of the antennae subequal, the second segment a little more than half as long as the third; mesonotum bronze reticulate with brown vittae; the abdomen with three or four pairs of prominent yellow spots.

Type from São Paulo, Brazil, in the American Museum. Two additional females from Nova Teutonia, Brazil, 1937 (Fritz Plaumann). Through the courtesy of Dr. Hull I have studied the type of *lachrymellea*.

Rhysops festiva, new species

Figures 13, 42

Similar to *lanei* Fluke, but the markings on the abdomen are more vittate. Length, 8.5 mm.

Male: Head heavily golden pollinose, a shining area just above the antennae, down the middle of the face with the upper part forked by a broad dash of pollen, which reaches to the base of the very low but elongate tubercle, also a shining area from the eyes to the oral angles; pile everywhere yellow except for a few black hairs near the front ocellus. Antennae relatively short, the first and third segments subequal, the second a little more than half as long as the third; arista yellow, the apical third dark.

Thorax: Mesonotum bronze reticulate, rather heavily coated with yellowish pollen, with three dark brown vittae, the median one slender; scutellum aeneous, the disc slightly rugose, the apex with two longer pale hairs; pleura yellowish pollinose; pile everywhere yellow.

Legs yellowish red to brown; the hind femora except the narrow base and tip, the hind tibiae and the apical four tarsal segments darker but almost black on the femora; pile of the legs mostly yellowish, black on the hind tibiae and upper sides of all the tarsi.

Wings hyaline, the stigma brown. Squamae dark brown, the fringe yellowish; plumule yellow; halteres yellow.

Abdomen opaque black, the sides shining; with three pairs of yellow spots; first pair on the second tergite reaching from the basal corners along the sides to the apical fifth; the second pair on the third tergite reaching from the base to the apical fourth; those on the fourth tergite reaching to the apical third. Pile mostly all yellow.

Type Material: Holotype, male, Baños, Ecuador, 1800 meters, July 4, 1938 (W. C. Macintyre).

Rhysops opaca, new species

Figure 15

A small, entirely black species, only the bases of the tibiae reddish. Face perpendicular with a prominent tubercle. Length, 5 to 6.5 mm.

Male: Head shining black, the sides of the face front and cheeks lightly dusted with white pollen; pile of the face and cheeks white, of the front black. Face nearly perpendicular with a large, well-rounded tubercle, deeply concave above tubercle. Ocellar triangle shining black, with black pile in front and brownish pile near occiput; cilia black, occipital pile yellow below. Antennae black, first segment longer than the second, shorter than the third, which is shorter than first two combined; arista black.

Thorax black; the mesonotum shining with two faint brownish pollinose vittae on the anterior half, pile long and brownish yellow; pile of the pleura shorter and whitish. Scutellum shining with the apical half rugose, pile mixed with short and long yellowish hairs, fringe short and yellow.

Legs black, basal one-fourth to one-third of the tibiae and the extreme apex of the femora reddish, but there is no sharp demarcation of the colors; pile sparse and pale.

Wings hyaline, the stigma yellowish brown. Squamae black, plumule yellow, halteres black with reddish stalks.

Abdomen opaque black, shining area along the sides somewhat resembling elongate side spots; pile long and yellow on the sides, very short, black and appressed on the discs.

FEMALE: On each side of the ocellar triangle a shining spot devoid of pollen and pile; frontal pile black with a few pale hairs in the triangular side dust spots. Mesonotal pile shorter and paler; in front of the scutellum brownish pollen can be observed in certain lights. Two pale setulose hairs on the rim of the scutellum. Legs sometimes somewhat more extensively red.

TYPE MATERIAL: Holotype, male, Urbina, Cerro Chimborazo, Ecuador, 3650 meters, April 18, 1939 (F. M. and H. Brown). Allotype, female, same data. Paratypes: seven males and 15 females, same data.

Rhysops minuscula, new species

Figures 16, 17, 47

A small species with a low tubercle and two shallow depressions above; antennae with the first and third segments about equal in length; abdomen with two pairs of yellow spots, which are often absent in the female. Length, 5.5 to 6 mm.

MALE: Face very highly polished blue-black; the tubercle low and with two faint transverse depressions, one immediately above the tubercle and the other about one-third the distance from the tubercle to the antennae; the median stripe is highly polished with a narrow gray pollinose vitta, which reaches from the base of the antennae almost to the first depression; this pollinose vitta connects with a narrow vitta, which follows down the sides of the face to the oral margin and connects with a broad patch of pollen, which in turn connects to a narrow strip along the eyes, broadening on the front with a narrow point projecting toward the antennae, but not quite reaching them; the pollen of the front is brownish black but bordered with gray pollen in front. Pile of the front and sides of the face black, whitish on the cheeks and the lower occiput. On each side of the face between the tubercle and the eyes is a flattened rugose patch which has about three ridges on the upper half of the patch. Ocellar triangle dark brown with coppery reflections; the pile all black; the cilia black. Antennae a little more than half as long as the face; the first and third segments about equal in length; the second about half as long as the first or third; segments yellow, the third black above and at the apex; arista yellow, basal segments and the tip darker.

Mesonotum dark brown to black with two faint brownish pollinose vittae on the anterior half. Pile of mesonotum is dark brown to black with paler hairs on the disc. On the notopleura there is a very prominent tubercle, which is located near the transverse suture. Scutellum highly polished with a greenish black hue, the pile light brown in color; on the rims two slightly longer hairs, which are well separated but approach the apex; the disc of the scutellum with about five faint transverse depressions. Pleura shining, very lightly pollinose especially around the propleura; the pile all yellowish brown.

Legs yellow, with a prominent black ring at the apex of the hind tibiae; the apical three segments of the tarsi brownish; the pile yellowish to dark brown with few black hairs appearing on the outer sides of the femora and tibiae; the tiny bristles under the mid-tarsi are somewhat brownish in color.

Wings hyaline, the stigma light brownish; squamae black, with black fringe; plumule light brown; halteres yellowish red.

Abdomen somewhat spatulate, opaque black but shining along the sides; with two pairs of yellow spots located in the anterior corners of the third and fourth tergites; pile yellowish and rather elongate along the sides of the second segment. The venter polished, the incisure between the second and third sternites yellow. Genitalia polished black, with black pile.

FEMALE: The pollen on the face is

whitish, as is also the pile; the front is wide with two large dark brown pollinose spots, which are narrowly connected and are located in front of the ocelli; a narrow band of white pollen separates the dark spots from the ocelli, and a narrow brown vitta runs from the median ocellus to the highly polished lunule. Mesonotum more shining blackish, with the vittae bluish in color and the pile all white. The abdomen is more oval, semi-shining on the disc, highly polished along the sides; the yellow spots often obscured.

TYPE MATERIAL: Holotype, male, Nova Teutonia, Brazil, June 8, 1937 (Fritz Plaumann). Allotype, female, same locality, June 2, 1937. Paratypes: 11 males, same locality, June 3 to September 1, 1937 and 1938; 15 females, same locality, June to October 24, 1937 and 1938.

MELANOSTOMA SCHINER

Narrow, dark flies; the antennae short, the first and second segments nearly equal in length, the second wider than long. Face may be perpendicular or protruding but very little produced downward, often with rippled or punctate spots in the pollen (subgenus *Carposcalis*). Legs normal in shape, although the front tibiae of the male may have strong bristles and the hind metatarsi may be somewhat enlarged. Abdomen usually narrow, although in the female often more oval; maculation usually present as pairs of yellow or reddish spots, sometimes absent or metallic but normally with white or brownish pollen. Genitalia usually small but sometimes large (subgenus *Talahua*).

Most of the species of this genus found in the Neotropical region have a heavy coating of pollen on the slopes of the face, which is also pilose, with a bare shining mid-stripe; the tubercle small to very large; a flattened area, which is slightly rugose, is present on the slopes of the face opposite the tubercle on virtually all species. The majority of the species also have a pair of whitish pollinose vittae on the anterior half of the mesonotum. Most of these characteristics, including a tubercle on the notopleura, are also common on species of *Rhysops*, and the only way to tell the two genera apart is by the length of the antennae.

There is a species occurring in Mexico which resembles the form *trichopus* Thomson, which is so common in California, but I am unable to determine its status so it is not included. It belongs to the *punctulatum* (*Carposcalis*) group but the pollen of the face is rippled; the bristles on the front tibiae of the male are weak and only four or five toward the apex.

TABLE OF SPECIES

(The species *annuliferum* Bigot, *bellum* Giglio-Tos, *limbatum* Enderlein, and *columbianum* Enderlein are not included.)

1. Antennae entirely black...........2
   Antennae partly yellow, at least below on the third segment........4
2. Face punctate..*fenestratum* Macquart
   Facial pollen non-punctate.........3
3. Face produced, carinate above the the tubercle, large species (11 mm.) ....*rex*, new species
   Face neither produced nor carinate, small species (7 mm.)............ ......*pictipes* Bigot var. (melanic)
4. Third segment of the antennae very large, round, more than twice as wide as the first segment.........5
   Third segment narrow, elongate, the upper edge nearly straight, not more than twice as wide as the first segment......................6
5. Pleura reddish, third segment of antennae circular................ ....*palliatum*, new species
   Pleura black, third segment of antennae slightly oval, large species (11 to 12 mm.)................. *M.* (*Talahua*) *fervidum*, new species
6. Four front femora and tibiae yellow.7
   Four front femora black or brown, at least on the basal fourth........10
7. Face above the tubercle carinate, elongate species................. ....*browni*, new species
   Face transversely rounded, not carinate.........................8
8. Pollen of face punctate............ ....*chalconotum* Philippi
   Pollen of face non-punctate, smooth.9

9. Hind femora reddish or yellowish on the basal half....*tropicum* Curran
Hind femora black, only very narrowly yellow at the base.....................*luculentum*, new species

10. Pollen of face finely rippled or clearly punctate, the oral margin usually jutting well forward.... 11
Pollen of face smooth or mostly absent..........................21

11. Males (eyes holoptic).............12
Females (eyes dichoptic)..........17

12. Spines on front tibiae nearly straight, at most only gently curved......13
Spines on the front tibiae strongly curved outward at the middle...15

13. Front tibiae with eight or nine strong spines, facial pollen very little punctate, abdominal spots reddish...............*ecuadoriensis*, new species
Front tibiae with four or five long spines, although there may be several shorter ones basally, facial pollen with many round punctate spots, abdominal spots metallic..14

14. Tubercle only shining...*stegnum* Say
Facial stripe reaches about halfway to the base of the antennae....................*chaetopoda* Davidson

15. Front tibiae with at least 12 outwardly curved spines.........................*fenestratum* Macquart
Front tibiae with five to eight such spines.......................16

16. Front tibiae with six to eight spines.................*punctulatum* Wulp
Front tibiae with five spines........................*saltanum* Enderlein

17. Front femora black on the basal half or more, face with large punctate spots.........................18
Front femora black on the basal third; face rippled, at most only finely punctate.....................20

18. Face with a median shining stripe..19
Only the tubercle shining...............................*stegnum* Say

19. Facial pollen clearly round, punctate, not rippled; oral margin greatly produced.......*punctulatum* Wulp
Facial pollen more rippled than punctate, oral margin less produced.............*chaetopoda* Davidson

20. Front wide, ocellar triangle one-third of the width at vertex; face more protruding.............................*ecuadoriensis*, new species
Front narrower, ocellar triangle more than one-third of the width; face less protruding..............................*fenestratum* Macquart

21. Legs entirely black, scutellum with 10 to 12 long black bristles on the margin, blue-black species....................*scutigerum*, new species
Legs partly yellow or orange colored, at least the four front tibiae largely yellowish....................22

22. Face jutting well forward into a cone, the tubercle almost absent; pollen of face sparse, whitish (Mexico)..................*meyeri*, new species
Face nearly perpendicular, tubercle very evident..................23

23. Small species (6 to 7 mm.), abdomen shining black (female)..................*pictipes* Bigot var. (melanic)
Larger species (7 mm. or more), abdomen with yellow spots........24

24. Pollen of face white; front large and inflated....*inflatifrons*, new species
Pollen of face yellow; front not inflated........................25

25. Face nearly perpendicular, with four transverse depressions above the tubercle.......*neotropicum* Curran
Face more prominent, without depressions........................26

26. Yellow spots on the third tergite of the abdomen almost as wide as long, quadrate; pile on the slopes of the face mostly black (male); on the female the spots are triangular...............*altissimum*, new species
Yellow spots of the third tergite more slender, about two and one-half times as long as wide; pile of the face mostly yellowish except near antennae; abdomen of female generally black, at most with small reddish spots.............................*bolivariensis*, new species

Melanostoma pictipes Bigot

Bigot, 1885, Ann. Soc. Ent. France, ser. 6, vol. 4, p. 78.

I have before me several females from Mexico City, 10,000 feet (H. G. Meyer), which have the abdomen entirely black and the legs also mostly black. For several years these were identified as *dubium* Zetterstedt, until three males of *dubium* were received from the mountains of Utah which possess a curled hair on the front femora. I, therefore, believe they are melanic forms of *pictipes* Bigot. The thin white pollen is evenly distributed over the slopes of the face, and there is a very small rugose area next to the eyes and just above the facial slits. The males I possess from Utah are mostly black pilose on the mesonotum.

Melanostoma (Carposcalis) stegnum (Say)

Figures 18, 55

Syrphus stegnum SAY, 1829, Jour. Acad. Nat. Sci. Philadelphia, vol. 6, p. 163.

This is the genotype of *Carposcalis* as designated by Enderlein, based on the enlarged hind metatarsi, the curved spines on the front tibiae, the punctate face, and the enlarged facets of the compound eyes.

The face is strongly punctate, similar to *punctulatum* but less produced, and only the tubercle is shining. The front tibia has four or five long straight spines on the apical half and 10 or 12 much shorter ones on the basal half. The femora are black, only their apices yellow. The mesonotum of the female is brilliantly shining with a bluish cast.

I have no authentic records of this species south of the California line. I believe that most of the Mexican forms will be found to be *chaetopoda* Davidson, and Enderlein's South American reports certainly refer to *punctulatum* or *fenestratum*.

Melanostoma (Carposcalis) chaetopoda Davidson

Figures 19, 56

DAVIDSON, 1922, Trans. Amer. Ent. Soc., vol. 48, p. 35 (California).

There should be no trouble distinguishing this species from its near relatives; the stripe of the face covers more than the tubercle but does not quite reach the antennae; face more perpendicular than *stegnum* and *punctulatum*. The front tibiae have six stout bristles that curve gently outward and the mid-tibiae have four, more slender but longer black bristles.

Eight males and two females from near Mexico City, Mexico, 10,000 feet, July, 1936 (H. G. Meyer).

Melanostoma (Carposcalis) punctulatum Wulp

Figures 20, 58

WULP, 1888, Tijdschr. Ent., vol. 31, p. 375.

Front tibiae of male with six to eight outwardly projecting spines; face of both sexes with large round punctate spots. Length, 7 to 8 mm.

MALE: Face protruding forward and a little downward, the pollen white and punctate, ending abruptly opposite the antennae, the pile black above but white on the lower slopes. Front with bronze reflections and long black pile. Ocellar pile black, upper cilia on the occiput long, black and yellow mixed; shorter and white below. First two segments of antennae together as long as the third; black, reddish below on the third segment.

Mesonotum semi-shining along the sides, the middle brownish pollinose; the pile yellow, black along the sides. Pleura white pollinose and yellowish pilose. Scutellum with long black or brownish pile, sometimes mostly brownish yellow, the fringe yellowish.

Legs black, the tibiae reddish to yellowish, the femora reddish on the apical one-third to one-half, narrowly on the hind femora. Front tibiae with six to eight strong spines on the outer side, the middle tibiae with four long black hairs.

Wings hyaline, the stigma yellow. Squamae dark brown, halteres brown, plumule white.

Abdomen opaque black, more shining apically and along the sides; the third and fourth tergites each with a pair of basal bronze-like spots covered with white pollen, visible in certain lights.

FEMALE: Quite similar. Pile of the mesonotum shorter and all yellow, ground color shining black with a slight bronze tint. Pile of scutellum yellow. Front femora normally all black except the apical third.

Bronze spots on the third and fourth tergites occupy more than half the length of the segments.

Described from 35 males and 18 females from Ecuador, all at high altitudes—2100 to 3300 meters (F. M. and H. Brown); one male from São Paulo, Brazil (H. S. Lopes); and one female from Victoria, Chile.

The outwardly curved spines (average seven in number) on the front tibiae, the punctate face, and the bronze spots will help to distinguish this species from its near relatives. The females of *ecuadoriensis* are very similar, but they have paler front femora, the punctate spots are smaller and less evident, and the face is more protruding. The females of *fenestratum* are also similar, but the facial pubescence is very finely punctate, and the front femora are also paler.

Melanostoma (Carposcalis) fenestratum (Macquart)

Figures 21, 57

Syrphus fenestratus Macquart, 1842, Diptères exotiques nouveaux ou peu connus, vol. 2, pt. 2, p. 103.

The male is readily recognized by the long row of black bristles the entire length of the front tibiae, 12 or 14 in number and all but the apical two or three strongly curved outward at the middle. Face punctation very fine and more ripple-like; on the females before me the punctation is more evident. The four front femora are mostly yellow, black on the basal third or fourth; mesonotum rather brilliant with bluish cast. The abdominal spots are metallic, sometimes with red showing, but are covered with white pollen.

Two males and one female from Chile, one female from Rio de Janeiro, Brazil, and one female from Miramar, which I believe is a coastal village or province of southern Argentina.

Melanostoma (Carposcalis) saltanum Enderlein

Carposcalis saltana Enderlein, 1937, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 200.

Enderlein compared this species with *stegnum* Say. His reference to five curved spines on the front tibiae and "bei *C. stegna* (Say, 1829) deren etwa 8" indicates clearly that he had *punctulatum* Wulp before him and had never seen the true *stegnum* Say of North America. His *saltanum* was taken in northern Argentina and is a very small species, only 5.5 mm. long.

I have a single small specimen taken at 4200 meters from Ecuador that might be this species, but the legs are much darker than those described for *saltanum*. This specimen has five curved spines on the front tibiae. The face protrudes considerably; the pollen is whitish and very little punctate; abdomen with two pairs of semi-quadrate brownish pollinose spots.

Melanostoma (Carposcalis) chalconotum (Philippi)

Figures 22, 23, 38

Syrphus chalconotus Philippi, 1865, Verhandl. Zool.-Bot. Gesellsch. Wien, vol. 15, p. 747.

Related to *punctulatum* Wulp. The third segment of the antennae more elongate; the front legs mostly yellowish red; abdomen (female) with four pairs of large reddish spots, which are lightly coated with white pollen, visible in side lights. Scutellum with four to eight black, bristle-like hairs on the margin. Length, 7 to 8 mm.

I place here somewhat doubtfully four females. Enderlein considered this species a variety of *stegnum* under his new genus *Carposcalis*. The punctate face is very typical of *punctulatum* but the paler front legs, more elongate antennae, and large reddish spots on the abdomen will readily separate out *chalconotum*.

I quote here a liberal translation of Philippi's original description: "Vertex, front and facial tubercle dark bronze, the face on the sides white with numerous small circular bronze spots very close together. The first antennal segment dark brown, the last brownish red except the upper third which is dark brown. The body is covered with whitish hair. The thorax, above and below, and the scutellum dark bronze green; the coxae, femora, and tibiae are reddish yellow. From *S. melanostoma* it differs also through the dark bronze green scutellum and the small size."

Four females: two, Riobamba, Ecuador, 2700 meters, April 19, 1939 (F. M. and H. Brown); one, Cuenca, Azuay, Ecuador, 2500 meters, February 22, 1939 (Brown); and one from Bogotá, Colombia, March 20, 1938 (Osorno).

Melanostoma (Carposcalis) ecuadoriensis, new species

Figures 25, 59

A high-altitude species in which the front tibia of male has usually eight outwardly pointing black bristles, and face projecting well forward. Closely related to *punctulatum* and *fenestratum.* Length, 6.5 to 7 mm.

MALE: Face jutting forward with a very small tubercle, lightly dusted with white pollen, which is little punctate, but the punctation shows clearly in some specimens; the pile black, mid-stripe narrow, two shallow *longitudinal* grooves just below the antennae. Front brownish pollinose, the pile black, cheeks large, white pollinose and white pilose. Ocellar triangle black with black pile, the upper cilia long and black. Antennae not reaching the facial tubercle; the first two segments shining black and together as long as the third, which is reddish, more brownish above; the arista brown.

Thorax blackish, the mesonotum with brown pollen and long black pile; scutellum slightly rugose before the tip; the pile black, fringe yellow. Pleura bronze, more bluish posteriorly; the pile white, a few black hairs just below the wings.

Legs black, the apical half of the four front femora and their tibiae yellowish, the hind tibiae reddish. Front tibiae on the outside with a row of strong, straight, black bristles, eight or nine in number, the basal two or three short, the apical three long; they all slant apically but are not strongly curved at the middle as on *punctulatum.* Mid-tibiae with four long, bristle-like hairs, the hind tibiae rather shaggy, black haired on the apical half.

Wings hyaline, the stigma yellow. Squamae whitish, the border and fringe brown; halteres brown; plumule white.

Abdomen slender, tapering, black with triangular yellow spots on third and fourth tergites, occupying the basal half of the segment but completely isolated, their inner ends pointed. Genitalia shining black. Pile, as usual, longer on the sides toward the base, yellowish. Venter shining black.

FEMALE: Dissimilar. Facial pollen abundant, punctate, but the punctations smaller than on *punctulatum,* pile white; front broader across the ocelli than the antennal length, a narrow transverse depression on the lower half, upper half and around ocelli with bluish reflections, the pollen sparse; occipital pile yellow above but the cilia mostly black. Mesonotum shining, slightly dulled by very minute brownish pollen, the pile white with black hairs along the sides; pleura heavily white pollinose and with all kinky white pile. Pile of scutellum mostly white, the border hairs longer and black.

Abdomen more oval with large bronze spots covered with white pollen, a median shining vitta from the first tergite to the fifth. Venter covered with white pollen.

TYPE MATERIAL: Holotype, male, Cuicocha, Imbabura, Ecuador, 3200 meters, May 27, 1939 (F. M. and H. Brown). Allotype, female, Cuenca, Azuay, Ecuador, 2500 meters, February 22, 1939 (F. M. and H. Brown). Paratypes: Ecuador, (F. M. and H. Brown): nine males and six females, same data as holotype; one female, same data as allotype; one female, Hacienda Talahua, Bolivar, 3100 meters, April 28, 1939; two females, Riobamba, 2800 meters, March 1, 1939; one female, Riobamba, 2700 meters, April 19, 1939; one female, Uyumbicho, Pichincha, 2650 meters, November 15, 1938; and five females, Hacienda Teno, Chillo Valley, Pichincha, 2500 meters, November 10, 1938.

The females of this species will be distinguished with difficulty from both *fenestratum* with its narrower front, less protruding face, less punctation of the facial pollen, and *punctulatum* with its darker legs, more brilliant mesonotum, and larger punctations on the face.

Some of the female paratypes may represent a different species, especially those from Pichincha Province, but there are no reliable characters to separate them. More collecting will undoubtedly disclose additional new species belonging to this group (*Carposcalis* Enderlein), but I strongly oppose erecting new species based upon females only in this difficult group.

Melanostoma meyeri, new species

Figure 24

Face jutting forward, pollen sparse, abdomen with definite yellow spots. Length, 9 to 10 mm

FEMALE: Head shining black, the oral margin protruding, lightly dusted with white pollen, the tubercle very small, the pile sparse and pale; rugose area just above the cheeks next to the eyes. Cheeks reddish with white pile. Front black, very lightly pollinose, with a median sulcus in front of the median ocellus, reaching to the shallow transverse depression, pile black. Occiput whitish pollinose and white pilose, a few scattered black hairs above. Antennae yellow, darker above on the third oval segment; arista brown.

Thorax shining black, the mesonotum inconspicuously brownish pollinose in front of the scutellum, white pollinose on the humeri; pile white, short and sparse on the mesonotum. Scutellum shining black, the pollen thin, the pile very short and pale, no longer hairs on the rim, fringe yellow.

Four front legs yellow, basal third of their femora shining black, a darkened apical ring on the tibiae, tarsi darker. Hind legs black, narrow base and apex of femora and almost the basal half of the tibiae yellow. Pile of the legs thin and short, all yellow except black on the hind metatarsi.

Wings lightly tinged yellowish, the stigma brown. Squamae white, the fringe yellow; plumule white; halteres yellow.

Abdomen semi-shining black, with four pairs of isolated reddish yellow spots, first three oblique; pile short, longer on the sides of the second tergite; white, black on the discs of the tergites. Venter shining yellow, large black spots in the middle of each sternite.

TYPE MATERIAL: Holotype, female, near Mexico City, Mexico, 10,000 feet, July, 1936 (H. G. Meyer). Paratypes: five females, same data.

Melanostoma tropicum Curran

CURRAN, 1937, Amer. Mus. Novitates, no. 926, p. 3.

Face perpendicular, the sides thickly coated with cinereous yellow pollen. Legs reddish, third pair brown with the basal half reddish. Abdomen with three pairs of reddish spots. Length, 10 mm.

The holotype is a male from São Paulo, Brazil, which I have not seen. I have before me a female which I believe belongs to this species in spite of the different locality.

It is similar to the female of *luculentum*, new species. On *tropicum*, however, the hind femora are yellow on almost the basal half and the face is more perpendicular and less produced below. The front is blue-black with a broad transverse golden pollinose band in the depression, the pile black. Pile of the thorax is short and yellowish on a background of thin brownish pollen. The abdominal spots are similar to the female of *luculentum*, except on the third and fourth tergites, where they reach the apical third and half, respectively.

A single female, Baños, Ecuador, 2300 meters, July 21, 1939 (W. C. Macintyre).

Melanostoma luculentum, new species

Figures 26, 46

Closely related to *tropicum* Curran. Four front tibiae and femora yellow, the hind femora dark, facial pollen smooth and yellowish in color, abdomen with lineate spots. Length, 10 mm.

MALE: Face slightly protruding, the tubercle low and elongate, covered with whitish yellow pollen and pile, a broad shining black mid-stripe one-third the width of face which does not quite reach the antennae; cheeks more thinly white pollinose and thinly white pilose; front with more brownish pollen, the two rough areas just above the antennae shining, pile black. Antennae yellow, the third segment darkened on the upper half and at the apex; arista reddish, darker toward the tip; first segment slightly longer than the second, the first two about as long together as the third. Upper occiput very thin, the cilia black; ocellar triangle black with black pile.

Thorax black, coated with brown pollen, heavier on the mesonotum, which has the usual broad, median, light brown vittae on the anterior half; the pile yellowish, rather long on the mesonotum and with darker hairs along the sides and near the scutellum, which is almost entirely shining with long yellowish to black hairs, rugose on the apical half, apex with two setulose hairs, the fringe yellow.

Legs yellow, the hind pair and all the tarsi dark brown; there is a dark streak on the upper side of the mid-femora toward the apex, and the hind femora are very narrowly yellow at the base and apex; pile yellow, black on the darkened areas.

Wings cinereous, with a slight smudge at the apex; the stigma dark brown. Squamae yellow, with black border and fringe; plumule white; halteres yellow with a darker knob.

Abdomen black with three pairs of lineate yellow side spots, the pair on the second tergite reaching from almost the base to the apical sixth, those on the third reaching from the base to the apical fifth, and the pair on the fourth reaching the apical third. The second and third pairs widen at the base nearly to the side margins but are not very distinct. Pile is, as usual, long and yellow along the sides on the anterior half, shorter and black apically. Venter is mostly shining, with a broad median black vitta, which is interrupted at the incisures.

FEMALE: Pollen of the face more golden in color; front shining black with a broad yellow pollinose band in the depression, pile black. Pile of the thorax and scutellum much shorter and all yellowish. Legs paler, the front coxae yellow, the tarsi mostly yellowish red, only the mid-segments of the front pair and the apical segments of the hind pair brownish. Abdomen with four pairs of yellow spots, those on the second tergite spreading out on the sides and converging posteriorly, an additional pair of fasciate spots on the fifth tergite.

TYPE MATERIAL: Holotype, male, Baños, Ecuador, 2300 meters, July 21, 1939 (W. C. Macintyre). Allotype, female, Pundoa, Ecuador, 2800 meters, July 17, 1939 (W. C. M.).

This species closely approaches *Rhysops*, but it has more of the general characteristics of *Melanostoma.* It is close to *tropicum* but has darker hind legs and the face is more prominent.

Melanostoma neotropicum Curran

CURRAN, 1937, Amer. Mus. Novitates, no. 926, p. 4.

I have been unable to recognize this species; apparently it has the general appearance of *R. nigrans*, new species, but the antennae are more typically those of a *Melanostoma.* In my key to the *Rhysops* species it will run to *nigrans* and *columella*, but the transverse depressions of the face are four in number, which will separate out *nigrans*, and the abdominal spots are lineate on the male, which will eliminate *columella.* All three species are from Brazil, *neotropicum* recorded from São Paulo on the basis of a single male.

Melanostoma browni, new species

Figures 27, 28, 44

Face perpendicular, carinate, the sides thickly golden pollinose, four front femora and tibiae yellow. Length, 10 mm.

MALE: Head black; face nearly perpendicular, the tubercle low yet broad, carinate above the tubercle, mid-stripe broad and shining; sides of the face, front above the shining black arc, and a narrow band below the antennae thickly golden pollinose; pile of face yellow, of front black; cheeks shining black with thin, more whitish pollen, pile white; ocellar triangle black with thin yellowish pollen, pile black; occiput with yellow hairs above, the long cilia black, pollen and pile paler below. Antennae reddish yellow, the first segment darker, the third darkened above, first two segments together about as long as third; arista long and black.

Thorax black, the shine of the mesonotum obscured by brown pollen, the usual two median pollinose vittae on the anterior half, pile long and yellow becoming black along the sides; pleura also coated with brownish pollen which is whitish posteriorly, the pile yellow; scutellum with long black hairs with some very short golden hairs intermixed; slightly rugose on the apical half, fringe long and yellow.

Legs yellow, the apical two-thirds of the hind femora, all but the apex of the hind tibiae, and the hind tarsi black to brown, the apical segments of the other tarsi usually brownish; pile sparse, black on the dark areas and on all the tibiae, long yellow hairs on the hind femora becoming black apically.

Wings hyaline, the stigma yellow. Squamae, halteres, and plumule yellow.

Abdomen long and slender, black with three pairs of lineate yellow spots, the pair on the second tergite separated from the base, sides, and apex; those on the third tergite reach from the base to the apical five-sixths; those on the fourth tergite similar but reaching only the apical half, all isolated from the sides; the pile long and yellow on the sides but black and shorter posteriorly.

Type Material: Holotype, male, Hacienda Talahua, Bolivar, Ecuador, 3100 meters, April 28, 1939 (F. M. and H. Brown). Paratypes: 12 males, same data.

The females of this species may be indistinguishable from *bolivariensis*, and I strongly suspect that some of the females listed under the latter species may be *browni*, but none of them exhibit the rather low but sharp ridge of the face above the tubercle, and they are also shorter.

Melanostoma bolivariensis, new species

Figures 29, 45

A dark species with even brown pollen on the face; abdominal spots small, elongate. Length, 7 to 8 mm.

Male: Face nearly perpendicular, projecting forward only slightly, the tubercle low but elongate, slopes evenly brown pollinose and yellow pilose, the mid-stripe bare almost to the antennae; cheeks thinly whitish pollinose and white pilose; front thickly covered with brown pollen and black pile except on the shining arch above the antennae; ocellar triangle very thinly brownish pollinose, the pile black; cilia black; occipital pile and pollen yellow, becoming white below. Antennae reddish, the first segment darker and the third black on the upper half; arista black.

Thorax black, the mesonotum semi-shining metallic; covered with brown pollen and brownish pile of various lengths, the tips black; pile black above the wings; two median whitish pollinose vittae on the anterior half; scutellum slightly rugose on the disc, the long pile black, fringe yellow; pleura with thinner yellowish pollen and pile.

Legs black, apical half of the front femora and their tibiae, apex of the mid-femora and their tibiae, the basal two segments of the mid-tarsi, and the basal half of the hind tibiae reddish to yellow. In teneral specimens the four front legs are often entirely yellow. Pile inconspicuous, the long hairs yellow.

Wings hyaline, the stigma yellow; squamae whitish, the border brown, fringe yellow; plumule white; halteres yellow, the knob dark.

Abdomen narrow, black with two pairs of narrow reddish side spots, the first pair on the third tergite reaching from the base to the apical half, the second pair on the fourth tergite smaller, reaching from the base to the apical third; white pollen on these spots; abdomen shining along the sides; the pile pale; genitalia small.

Female: Similar, the facial pollen somewhat paler; frontal pollen in a transverse band on the lower half in a distinct depression, upper half nearly bare; front at vertex about two and one-half times as wide as ocellar triangle. Mesonotal pile sparse and much shorter. Abdominal spots often absent but when they show clearly are reddish dashes converging posteriorly. Legs more extensively yellow, the hind femora often yellow on the basal fourth.

Type Material: Holotype, male, Hacienda Talahua, Bolivar, Ecuador, 3100 meters, April 28, 1939 (F. M. and H. Brown). Allotype, female, same data. Paratypes: 22 males and 23 females, same data.

The numerous specimens of this species

taken on the same day strongly suggest that the species is very common and may be known by some other name. However, it was not represented from any other localities in Ecuador where F. M. Brown collected. As indicated under *browni*, some of these females may belong to that species.

Melanostoma altissimum, new species

Figures 48, 49

Very similar to *bolivariensis*, new species, but the facial pile of the male is mostly black and the abdominal spots are entirely different, quadrate on the male and triangular on the female. It may represent only a variety. Length, 8 mm.

MALE: The description of *bolivariensis* will apply except for the following characters: Pile of the face mostly black, yellow only on the lower slopes; pile of the mesonotum mostly black; color of the legs more extensively black, the front tibiae mostly brownish with a dark median ring; pile of the genitalia black (yellow on *bolivariensis*); abdominal spots wider, almost quadrate, reaching less than half the length of the third and fourth tergites. Second tergite shows evidences of narrow elongate spots.

FEMALE: Differs from *bolivariensis* only in the darker legs and triangular spots on the abdomen; second tergite with a pair of elongate oval spots; third and fourth with triangular spots; third, inner margins parallel, their outer margins converging, separated from the lateral margins; smaller spots on the fifth tergite. The spots are quite similar to the common North American species *pictipes* Bigot.

TYPE MATERIAL: Holotype, male, Cuicocha, Imbabura, Ecuador, 3200 meters, May 27, 1939 (F. M. and H. Brown). Allotype, female, same data. Paratypes: two males, same data; and one male, Bogotá, Colombia, March 25, 1937 (Osorno), in the collection of F. M. Hull.

This species may prove to be only a variation of *bolivariensis*, new species, but the constant characters of the latter species, as seen in 47 specimens, indicate that *altissimum* is distinct. The head shapes and pollen of the two are identical.

Melanostoma scutigerum, new species

Figure 30

Blue-black with a row of bristles on the rim of the scutellum. Length, 7 to 7.5 mm.

MALE: Face perpendicular with a broad oval shining mid-stripe; the sides evenly white pollinose, converging just below the antennae; the pile black; tubercle low but definitely limited above. Cheeks lightly white pollinose and white pilose. Front with a prominent transverse shining black ridge just above the antennae, with a pair of shallow depressions above, and a median sulcus, which reaches to the brownish to blackish pollinose apex; pile black. Ocellar triangle brownish pollinose, pile black; upper occiput black pilose and brownish pollinose; lower occiput white pollinose and white pilose. Antennae yellow, the third segment brown on the apex and above; first two segments about equal in length, together equal to the third; arista black.

Thorax black, covered with brown to black pollen and black pile; the sides of the mesonotum, the pteropleura, and hypopleura more shining bluish; two median whitish pollinose vittae on the anterior half of the mesonotum. Scutellum non-rugose, with black pile and a series of about 12 black spines on the rim, the downward projecting fringe black.

Legs black, brownish pollinose; the pile black, more yellowish brown beneath the tarsi.

Wings tinged with brown, darker along the fore margin. Squamae brown, the fringe yellowish; plumule brown; halteres black with yellow knobs.

Abdomen oval, everywhere black; no indication of yellowish spots; the pile black, white in areas where spots would normally occur.

FEMALE: Very similar. The front with a broad transverse depression white to brownish pollinose, which is black near the ocelli; ocellar area shining blue. Scutellar fringe yellow. Squamae yellow. Pile of the abdomen shorter and paler anteriorly.

TYPE MATERIAL: Holotype, male, Uyumbicho, Pichincha, Ecuador, 2700 meters, November 4–13, 1938 (F. M. Brown). Allotype, female, same data.

Melanostoma inflatifrons, new species

Figure 31

A small black species with large cheeks and front, face evenly pollinose, the facial tubercle large and shining. Length, 5 to 7 mm.

FEMALE: Face, cheeks, and front evenly coated with grayish to yellowish pollen; the prominent tubercle, a streak from the oral edge to the eyes, and an arc above the antennae shining. Cheeks very full, the front wide, the ocellar triangle only one-third the width of front at vertex. Pile of face and cheeks white, of the front long and black, of the upper occiput black with a few scattered white hairs. Antennae black, the third segment yellow at the base and below.

Thorax black and grayish pollinose, with faint brownish vittae on the mesonotum; pile white, black on the mesonotum. Scutellum with a pre-apical depression; pile black on the apex with longer black hairs.

Legs reddish brown; the four front femora black on the basal fourth, the hind femora on the basal half; all the tarsi black. Pile mostly pale.

Wings cinereous, the stigma brown. Squamae white, the edge and fringe brown; plumule white; halteres brownish.

Abdomen black, pollinose, with three pairs of reddish yellow hoary spots: on the second tergite as side median triangles, on the third and fourth tergites as transverse spots reaching the sides but not touching the basal margins. The fifth tergite with small similar spots in the basal corners. Venter white pollinose, broadly yellow at the incisures.

MALE: Similar, the front inflated and broad; pile of face and pleura mostly black. Pile on the legs longer and many of the hairs are black, but no peculiar hairs or bristles present.

TYPE MATERIAL: Holotype, female, Hacienda Talahua, Bolivar, Ecuador, 3100 meters, April 28, 1939 (F. M. and H. Brown). Allotype, male, same data. Paratypes: one pair, same data.

Melanostoma rex, new species

Figures 32, 50

A large species with protruding face, which is carinate above the tubercle; antennae black; abdomen with lineate yellow side spots. Length, 10 to 11 mm.

MALE: Head black; sides of the face broadly, cheeks thinly, and the front except the shining arc above the antennae, yellow to golden pollinose; the pile black except for yellow hairs on the lower slopes of the face, the cheeks, and the lower occiput. Ocellar triangle with golden pollen and long black hairs, cilia black. Oral tips protruding well forward and downward; the tubercle broad and long; face with a very broad stripe free of pollen, and with a median sulcus just below the antennae. A very prominent triangular rugose area on the slopes of the face opposite the tubercle. First segment of antennae longer than the second, shorter than the third, entirely black; arista black.

Thorax semi-shining, the mesonotum with golden pollen and black and yellow hairs intermixed, nearly all black along the sides, the usual two median gray pollinose vittae on the anterior half; scutellum shining but with a thin coating of golden pollen, the pile very long and black with a few shorter yellow hairs intermixed, the fringe long and yellow. Pleura yellowish white pollinose, the pile yellow, black on the mesopleural hump and just below the wings on the pteropleura.

Legs black; the four front femora yellow except for the basal one-fourth to one-third; the four front tibiae yellow except a pre-apical dark ring; hind femora on the underside near the apex also yellowish; apical segment of the four front tarsi reddish yellow; pile mostly black, with a few yellow hairs toward the bases of the femora.

Wings hyaline, the stigma yellow. Squamae yellow, with brown border and fringe; plumule and halteres yellow, the knobs darkened.

Abdomen elongate, slender, black; second to fourth tergites each with a pair of narrow yellow side vittae, those on the second entirely isolated, those on the third reach the base and extend to the apical fifth, those on the fourth similar and extend to the apical third. Venter yellow, with a broad, median, black vitta.

FEMALE: Very similar, the legs much paler; the four front femora and tibiae yellow; the hind femora yellow except for a dark streak on the outside near the apex, in some specimens most of the hind femora dark. Pile on the mesonotum not so long, fewer black hairs.

TYPE MATERIAL: Holotype, male, Hacienda Talahua, Bolivar, Ecuador, April 28, 1939 (F. M. and H. Brown). Allotype, female, same data. Paratypes: 14 males and eight females, same data.

The produced face and black antennae readily place this large species.

Melanostoma palliatum, new species

Figures 33, 35, 51, 52

Face slightly receding with a large rounded tubercle similar to *fervidum;* third segment of antenna almost circular; pleura reddish; abdomen with prominent yellowish red spots on the male. Length, 9 to 10 mm.

FEMALE: Head black, the face and lower half of the front except the tubercle and arch above the antennae covered with brownish pollen, the pile black; cheeks yellowish pollinose and yellow pilose; upper half of front and ocellar triangle shining, the pile black, becoming brown on the vertex and occiput; pollen of occiput brown. Antennae reddish; the first segment black; the third blackened on the upper third; the third almost round; arista short, black. This species has only a small faint rugose area on the face opposite the tubercle.

Mesonotum shining with coppery reflections, lightly whitish pollinose on the sides; pile short and golden in color with intermixed longer black hairs on the disc, white on the notopleura; scutellum emarginate with golden pile and a few long black hairs, which are more numerous on the rim, the fringe yellow; pleura reddish, with white pollen and pile. Notopleura with prominent tubercle.

Legs reddish, the tarsi darker; pile mostly yellowish black above on the tarsi, inconspicuous except for longer hairs on the outsides of the femora.

Wings hyaline; the stigma brownish. Squamae yellow, with brown border and fringe; halteres yellow with black knobs; plumule white.

Abdomen oval, semi-shining black with four pairs of yellowish spots, which are located in the basal corners of the second to fifth tergites. All spots coated with white hoar pollen. First segment narrowly yellow on the sides; spots on the second tergite large, reaching the apical third; those on the third and fourth tergites fasciate, reaching only about one-third the length of segment; those on the fifth triangular; all spots go over the sides. Venter yellow, coated with white pollen.

MALE: Darker, the pile of the head nearly all black; on the mesonotum many more black hairs and those on the pleura yellow. Only the meso- and ptero-pleura dark reddish. Legs black, the front legs somewhat reddish brown. Abdomen with prominent large oval spots, which occupy most of the third and fourth tergites, smaller on the second tergite.

The spotting on the abdomen and the slightly receding face suggest *Xanthandrus*, but I know of no species of this genus with reddish pleura and round third antennal segment. The facial tubercle is also too prominent for a typical *Xanthandrus*.

TYPE MATERIAL: Holotype, female, Minza Chica, Tungurahua, Ecuador, 3200 meters, April 8, 1939 (F. M. Brown). Allotype, male, same data. A second female is definitely a variety: the mesonotum has a bluish cast, and the abdominal spots are narrow and much smaller. It was taken at Hacienda Talahua, Bolivar, Ecuador, 3100 meters, April 28, 1939 (F. M. Brown).

MELANOSTOMA SUBGENUS TALAHUA, NEW SUBGENUS

Figure 36

Separated from *Melanostoma* by the large genitalia of the male; styles and cerci elongate, nearly as long as the fourth tergite.

TYPE: *Talahua fervidum*, new species.

Melanostoma (Talahua) fervidum, new species

Figures 34, 36, 53

A large species; face perpendicular with a well-rounded tubercle; third segment of antennae large and rounded; abdomen with prominent yellow spots; genitalia of male elongate. Length, 11 to 12 mm.

MALE: Head large, wider than the thorax and abdomen; covered with yellowish gray pubescent-like pollen, shining black on the prominent round tubercle, oral tips, ocellar triangle, and a large triangular spot on the front; sides of face with a faint, slightly rugose area; pile on front black, on cheeks and face yellow, on ocellar triangle black, on the occiput yellow except the upper cilia, which are black. Antennae black, the second segment and the lower basal corner of the third red; arista bare, black.

Thorax black, the mesonotum shining, covered with yellow pollen and short golden pile with many longer black hairs that appear yellowish at the base; these hairs become longer posteriorly and longer on the scutellum, which has a deep groove next to the rim (emarginate), fringe of scutellum yellow; pleura yellow pollinose and pilose.

Legs black; the front femora yellow on the apical two-thirds, the middle femora on the apical third, the hind on the extreme apex; all the tibiae yellow with a dark ring near the middle, more prominent on the hind pair; the pile yellow, black on the hind tibiae and above on the tarsi.

Wings smoky; the stigma brown; squamae and plumule yellow; halteres yellow, with a darkened knob.

Abdomen elongate, black, with four pairs of yellow side spots; first tergite shining, second with the broad sides yellow and only the apex black, third with similar but wider spots, fourth with still wider but less elongate spots, fifth with a pair of small spots in the basal corners. Pile yellow on the sides basally, black down the middle and on the apical segments. Genitalia very large, the styles long and black, the cerci elongate and yellow.

FEMALE: Very similar but the abdominal spots are somewhat shorter. Front narrow above, not the much wider than ocellar triangle, shining above with a pollinose band below.

TYPE MATERIAL: Holotype, male, Hacienda Talahua, Bolivar, Ecuador, 3100 meters, April 28, 1939 (F. M. and H. Brown). Allotype, female, same data. Paratypes: three males and one female, same data.

Melanostoma columbianum Enderlein

ENDERLEIN, 1937, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 198.

I have been unable to recognize this species among the many specimens at hand from Ecuador. It should be easily recognized by the microscopic transverse furrows (scratches) "feinen und dichten." The facial pollen is brownish, the third segment of the antennae one and one-third times as long as wide, abdomen with two pairs of yellowish oblique spots; legs reddish yellow, the hind femora light brown. Length, nearly 8 mm. It is unfortunate that Enderlein has used the name *columbianum* in two such closely related genera as *Rhysops* and *Melanostoma*. *M. columbianum* was described from a single female.

Melanostoma limbatum Enderlein

ENDERLEIN, 1937, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 198.

I have been unable to recognize this species, which was described from northern Argentina. The pollen of the face is white and punctate on the female, apparently non-punctate on the male. Third segment of the antennae one and two-thirds times as long as wide. Thorax shining black, with thick brownish yellow pile. Abdomen (male) with three pairs of yellow spots (female with four). Legs yellowish, the hind pair brown except the knees and base of the femora.

I know of no species treated here that might be this except possibly *Rhysops lineata* Fluke, which was also described in 1937.

In addition to the species previously discussed, the following four species, all of which apparently belong in the genus *Melanostoma*, *sensu lato*, have been described from South America. The original descriptions are here repeated in order to complete a review of the tribe.

Melanostoma lundbladi (Enderlein)

Carposcalis lundbladi ENDERLEIN, 1940, *in* Skottsberg, The natural history of Juan Fernandez and Easter Island, vol. 3, p. 665.

"Length, $5^1/_2$ mm.; length of wing, $6^1/_3$ mm.

"FEMALE: Head black with thick brownish-tinged grayish white pollen, that on the sides of the face with numerous punctiform spots. Front, vertex, and occiput somewhat bluish metallic, wholly without pollen. Face not excavated above the strong tubercle, which is situated above the lower third. Above with strong keel, the tubercle compressed above; tubercle and keel wholly narrow, bare, and polished. Antennal pits without a median projection. Antennae wholly black, first segment large, as long as wide; second segment narrow, somewhat shorter than broad; third unusually broad and somewhat hatchet shaped. Vertex and cheeks with white erect pubescence. Thorax black above, moderately bare and with bluish sheen, that on the scutellum more obvious than reddish blue, that toward the back of the mesonotum somewhat stronger and clear blue. Underside, plurae, and humeri with white pollen. Plurae with longer fine white hair. Halteres and squamae rusty brownish. Abdomen black, the anterior third with the exception of the middle fourth with dull grayish color, the whole somewhat with weak mother-of-pearl sheen. Legs, except the coxae, rust colored; front tarsi brown, the fourth and fifth segments of the middle and hind tarsi brownish. First segment hind tarsi two-thirds as long as the tibia and somewhat strongly thickened. Wings hyaline, stigma pale brownish yellow, veins yellowish brown.

"Juan Fernandez: Masatierra, August, 1917." (Translated by C. H. Curran.)

Melanostoma reynoldsi Shannon and Aubertin

SHANNON AND AUBERTIN, 1933, Diptera of Patagonia and South Chile, pt. 6, fasc. 3, p. 134.

"Rather a small fly with bluish abdominal markings and dark shining green thorax; the face, except in the middle line, is covered with grey tomentum and has a punctate appearance.

"Male, Female. Length, 7 mm.; wing, 6.5 mm.

"Head: Eyes bare, in male contiguous for a short space, in female separated at vertex by distance equal to two-thirds width of one eye; frons dull greenish-black, rather more shining in female than in male, clothed with upstanding black hairs; face in profile slightly tuberculate, not protruding, clothed, except for central and two lateral streaks, with grey tomentum, through which the shining black ground shows in numerous small spots (as in *M. fenestratum*, Macq.); antennae dark brown, third segment reddish below.

"Thorax dull greenish-black, pale-haired, pubescence shorter and thinner in female than in male.

"Abdomen dull black, pale-haired, in male with pale bluish-grey spots on anterior external margins of third and fourth visible segments, female with a pair of spots on second visible segment as well.

"Wings hyaline; squama white with pale fringes; halteres dark brown.

"Legs dark brown, darker in male than in female; hind metatarsi considerably swollen in male, less so in female.

"Holotype, male, allotype, female, and paratypes, 4 males, Tierra del Fuego, Rio Grande, Estancia Viamonte, xii, 1929 (P. W. Reynolds)."

Melanostoma edwardsi Shannon and Aubertin

SHANNON AND AUBERTIN, 1933, Diptera of Patagonia and South Chile, pt. 6, fasc. 3, p. 133.

"A fly with yellow abdominal markings, brown legs and greyish thorax; face thickly covered with grey tomentum.

"Male. Length, 10 mm.; wing, 8 mm.

"Head: Eyes bare, contiguous for a short space; ocellar triangle, frons and face black, latter evenly covered with grey tomentum and bearing a sparse covering of pale and dark hairs; face in profile tuberculate, not markedly protuberant, opening of epistome being about twice as long as broad; antennae black.

"Thorax shining aeneous, pale-haired,

dorsum with two faint longitudinal stripes; humeri, post-alar calli and pleurae very thinly dusted with grey tomentum.

"Abdomen black, second, third, fourth and fifth visible segments with paired yellow spots, thinly dusted with grey tomentum; venter testaceous.

"Wings hyaline; squama white with pale fringe; halteres with dark brown knobs and rather paler stems.

"Legs: front and middle legs reddish-brown, femora and tarsi darkened; hind legs dark brown, femora almost black in middle; hind metatarsi slightly swollen.

"Holotype, male, Bariloche."

Melanostoma productus (Macquart)

Syrphus productus Macquart, 1850, Diptères exotiques, suppl. 4, p. 154.

"Thorax greenish, shiny. Abdomen elongate, black with lateral yellow spots. Head greenish, face produced. Legs testaceous, the posterior femora brownish.

"Length, 8 mm.

"Male and Female: Face produced, blackish green, covered with white pollen on the sides. Front of female with transverse depression. Antennae with the first two segments black, the third oval with rounded apex, of a yellowish brown color in the male; brownish black in the female. Abdomen with second, third, and fourth segments, with triangular yellow spots, the fifth bronze. The venter with similar spots. Legs testaceous, posterior femora brown with the end testaceous; first segment of posterior tarsi a little swollen. Wings with the stigmal cell yellowish, the venation normal.

"From Chile." (Translated by C. H. Curran.)

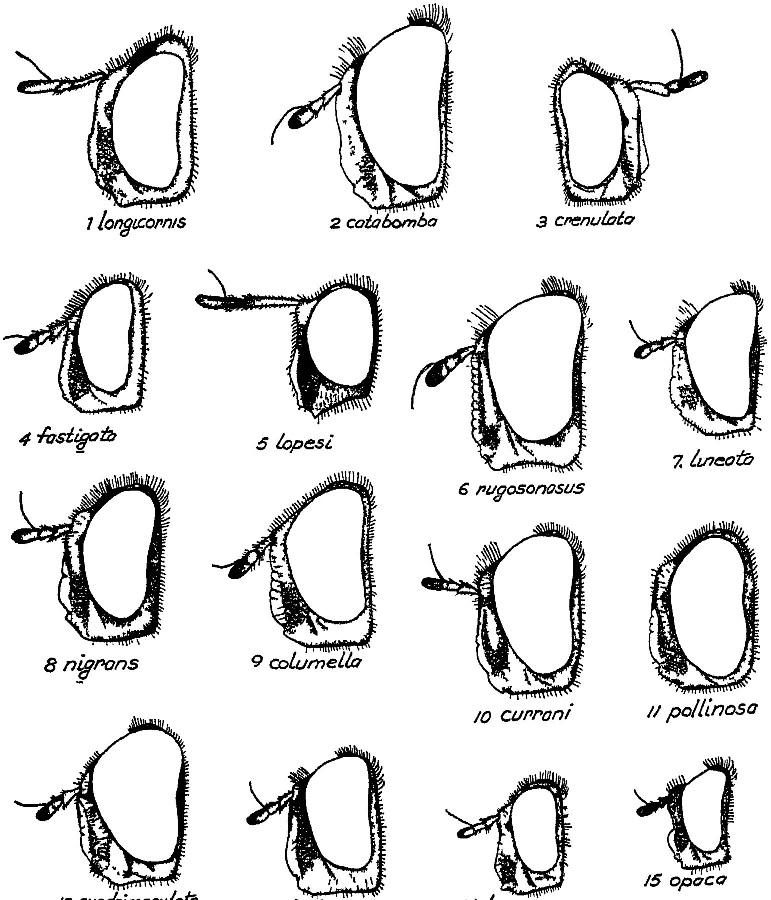
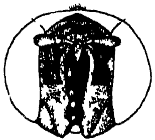
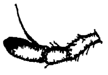


Fig. 1. *Rhysops longicornis* (Williston), profile of head of female.
Fig. 2. *Rhysops catabomba* (Williston), profile of head of male.
Fig. 3. *Rhysops crenulata* (Williston), profile of head of female.
Fig. 4. *Rhysops fastigata*, new species, profile of head of female.
Fig. 5. *Rhysops lopesi*, new species, profile of head of female.
Fig. 6. *Rhysops rugosonasus* (Williston), profile of head of male.
Fig. 7. *Rhysops lineata* (Fluke), profile of head of male.
Fig. 8. *Rhysops nigrans*, new species, profile of head of female.
Fig. 9. *Rhysops columella*, new species, profile of head of female.
Fig. 10. *Rhysops currani* Fluke, profile of head of male.
Fig. 11. *Rhysops pollinosa* Hull, profile of head of female.
Fig. 12. *Rhysops quadrimaculata* Hull, profile of head of male.
Fig. 13. *Rhysops festiva*, new species, profile of head of male.
Fig. 14. *Rhysops lanei* (Fluke), profile of head of female.
Fig. 15. *Rhysops opaca*, new species, profile of head of male.
All drawings were made with the aid of the camera lucida.


16 minuscula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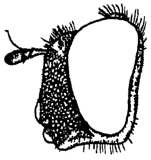
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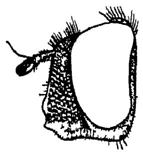
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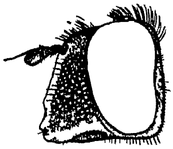
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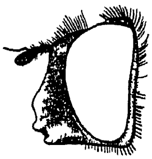
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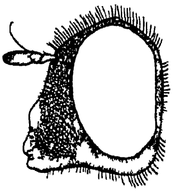
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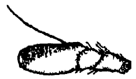
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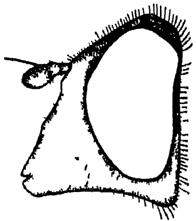
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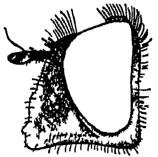
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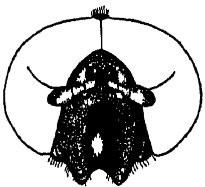
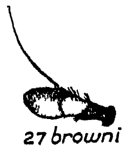

26 luculentum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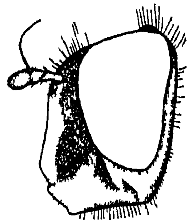
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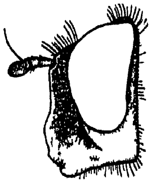
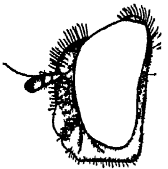

29 bolivariensis


30 scutigerum

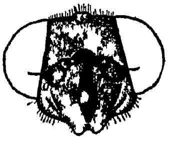
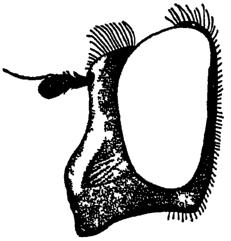

31. inflatifrons

Fig. 16. *Rhysops minuscula*, new species, front view of head of male.
Fig. 17. *Rhysops minuscula*, new species, antenna.
Fig. 18. *Melanostoma stegnum* (Say), profile of head of male.
Fig. 19. *Melanostoma chaetopoda* Davidson, profile of head of male.
Fig. 20. *Melanostoma punctulatum* Wulp, profile of head of male.
Fig. 21. *Melanostoma fenestratum* (Macquart), profile of head of male.
Fig. 22. *Melanostoma chalconotum* (Philippi), profile of head of male.
Fig. 23. *Melanostoma chalconotum* (Philippi), antenna.
Fig. 24. *Melanostoma meyeri*, new species, profile of head of female.
Fig. 25. *Melanostoma ecuadoriensis*, new species, profile of head of male.
Fig. 26. *Melanostoma luculentum*, new species, front view of head of male.
Fig. 27. *Melanostoma browni*, new species, antenna.
Fig. 28. *Melanostoma browni*, new species, profile of head of male.
Fig. 29. *Melanostoma bolivariensis*, new species, profile of head of male.
Fig. 30. *Melanostoma scutigerum*, new species, profile of head of male.
Fig. 31. *Melanostoma inflatifrons*, new species, front view of head of female.
All drawings were made with the aid of the camera lucida.



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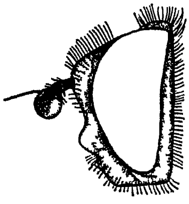
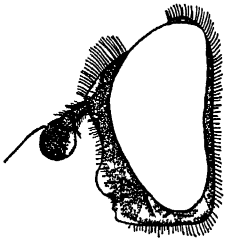
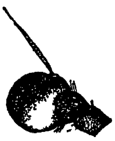


33 palliatum



34. fervidum



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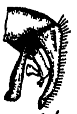
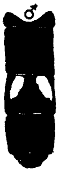
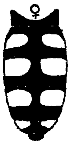


36. fervidum



37 fastigata



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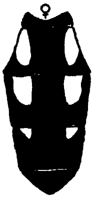
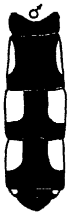
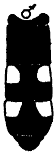


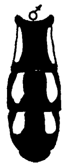
39 columella



40 columella



41 quadrimaculata



42 festiva

Fig. 32. *Melanostoma rex*, new species, profile of head of male.
Fig. 33. *Melanostoma palliatum*, new species, profile of head of male.
Fig. 34. *Melanostoma fervidum*, new species, profile of head of male.
Fig. 35. *Melanostoma palliatum*, new species, antenna.
Fig. 36. *Melanostoma fervidum*, new species, genitalia.
Fig. 37. *Rhysops fastigata*, new species, abdomen, male.
Fig. 38. *Melanostoma chalconotum* (Philippi), abdomen, female.
Fig. 39. *Rhysops columella*, new species, abdomen, female.
Fig. 40. *Rhysops columella*, new species, abdomen, male.
Fig. 41. *Rhysops quadrimaculata* Hull, abdomen, male.
Fig. 42. *Rhysops festiva*, new species, abdomen, male.
All drawings were made with the aid of the camera lucida.

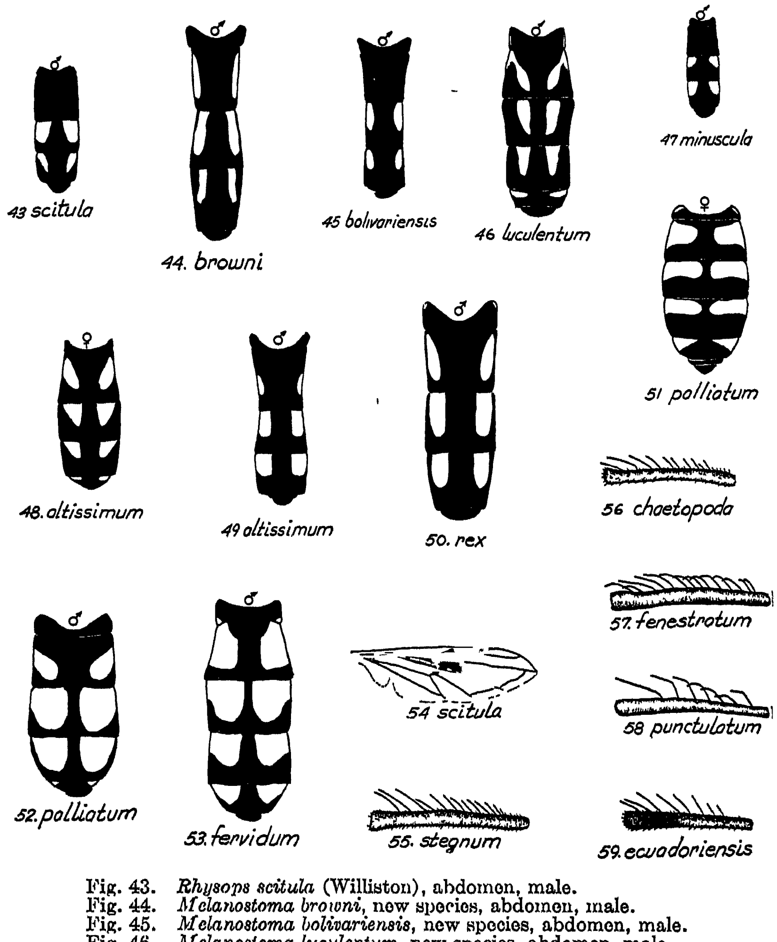


Fig. 43. *Rhysops scitula* (Williston), abdomen, male.
Fig. 44. *Melanostoma browni*, new species, abdomen, male.
Fig. 45. *Melanostoma bolivariensis*, new species, abdomen, male.
Fig. 46. *Melanostoma luculentum*, new species, abdomen, male.
Fig. 47. *Rhysops minuscula*, new species, abdomen, male.
Fig. 48. *Melanostoma altissimum*, new species, abdomen, female.
Fig. 49. *Melanostoma altissimum*, new species, abdomen, male.
Fig. 50. *Melanostoma rex*, new species, abdomen, male.
Fig. 51. *Melanostoma palliatum*, new species, abdomen, female.
Fig. 52. *Melanostoma palliatum*, new species, abdomen, male.
Fig. 53. *Melanostoma fervidum*, new species, abdomen, male.
Fig. 54. *Rhysops scitula* (Williston), wing.
Fig. 55. *Melanostoma stegnum* (Say), front tibia of male.
Fig. 56. *Melanostoma chaetopoda* Davidson, tibia of male.
Fig. 57. *Melanostoma fenestratum* (Macquart), tibia of male.
Fig. 58. *Melanostoma punctulatum* Wulp, tibia of male.
Fig. 59. *Melanostoma ecuadoriensis*, new species, tibia of male.
All drawings were made with the aid of the camera lucida, bases of the tibiae are to the right.

AMERICAN MUSEUM NOVITATES

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HESPEROCHERNES CANADENSIS, A NEW CHERNETID PSEUDOSCORPION FROM CANADA[1]

BY C. CLAYTON HOFF[2]

Included in the collection of pseudoscorpions from the American Museum of Natural History, the writer found two individuals from Canada, representing a species described herein as new. The type specimens are deposited in the American Museum of Natural History. Description is based on individuals cleared in beechwood creosote and mounted in balsam, the body being treated with potassium hydroxide before clearing.

Hesperochernes canadensis, new species

Figures 1–7

MALE: Body moderately stout, brownish in color, length 2.3 mm. Carapace somewhat longer than wide, brown, granular; posterior margin finely serrate and very weakly convex; lateral margins posteriorly subparallel, convex anteriorly; anterior margin well rounded, appearing, however, medially subtruncate as a result of the persistent cheliceral membrane; two transverse furrows; the anterior furrow deeply impressed and located slightly posterior to the midpoint of the carapace; posterior furrow less impressed and closer to the posterior margin of the carapace than to the anterior furrow; setae subclavate, terminally multidenticulate; posterior disc with 18 setae, median disc with more than 20 setae, anterior disc with more than 30; a single pair of eyes located near the anterior margin of the carapace; length of carapace 0.82 mm., greatest width 0.69 mm.

Abdomen subovate, length 1.5 mm., greatest width 1.2 mm. Tergites except the eleventh divided, granulate; setae subclavate, multidenticulate; a single row of marginal setae in tergites 1 and 2, each posterior half tergite with a marginal row, a lateral seta, a medial seta, and one seta somewhat anterior to the marginal row near the center of the half tergite; total setae for tergites 1 through 10 as follows: 16–18:18–20:18–22:20:20:20:18–20:18–20:18:14–16 (variation results from an unequal number of setae in the two halves of the same tergite); each half tergite with five or six slightly curved, rod-like lyrifissures dispersed along the posterior margin and as many as 20 minute discoidal lyrifissures scattered over the face; eleventh tergite subtriangular with eight relatively long, multidenticulate setae and on each side a single acuminate, pseudotactile seta. Sternites 4 through 10 divided; sculpturing slightly weaker but color as in the tergites; setae simple and acuminate, confined chiefly to a somewhat irregular marginal row; total setae for sternites 4 to 10 as follows: 14:22:22:20–24:20–22:16:14; six to eight longer acuminate setae on the eleventh sternite, including a pair of long pseudotactile setae; some sternal scuta with as many as 18 or more microlyrifissures and three or four rod-like, sometimes slightly curved lyrifissures near the posterior margin. Pleural membranes strongly wrinkled, subpapillate, with but slight indication of longitudinal plications. Each anterior stigmatic plate with three setae; right posterior stigmatic plate with two setae, left apparently with only one.

Chelicera: Length 0.26 mm., width of base 0.145 mm., basal and subbasal setae shorter than the interior and laminal setae; subbasal seta with a few subterminal denticulations; flagellum with four blades, the distal one serrate along the anterior

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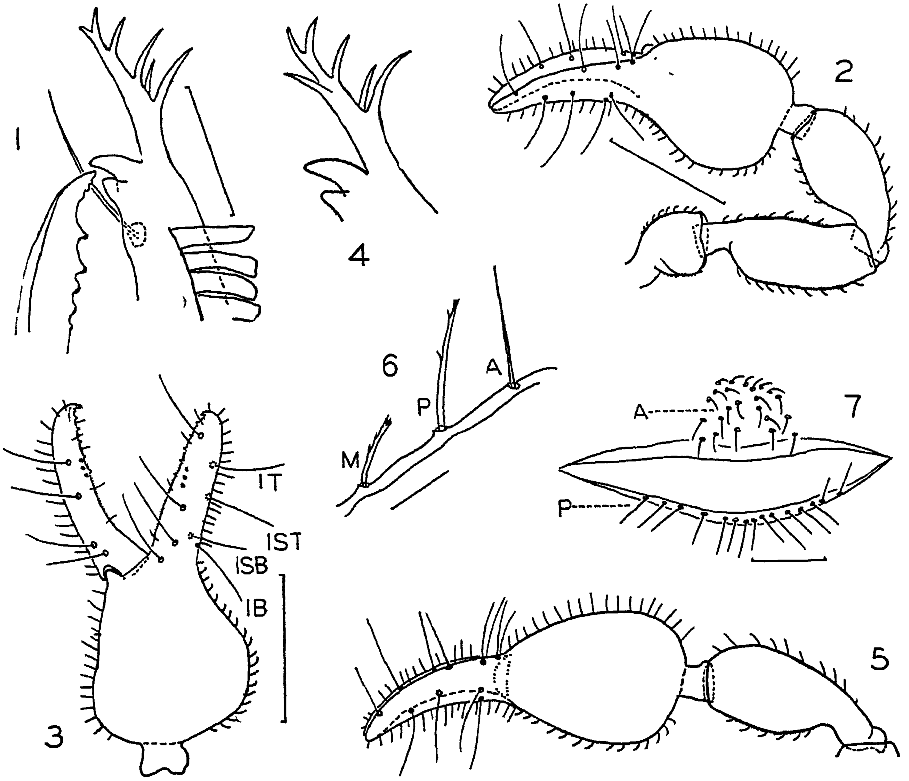
[1] This investigation was assisted by a Grant-in-Aid from the Sigma Xi Research Fund.

[2] Quincy College, Quincy, Illinois.



Hesperochernes canadensis, new species

Fig. 1. Apical portion of chelicera, male holotype. Serrula interior omitted. Scale equals 0.05 mm.

Fig. 2. Dorsal view of palp of male holotype. Scale equals 0.5 mm.

Fig. 3. External view of chela, male holotype. Scale equals 0.5 mm. IB, interior basal seta; ISB, interior subbasal seta; IT, interior terminal seta; IST, interior subterminal seta.

Fig. 4. Galea of female allotype. Scale as in figure 1.

Fig. 5. Dorsal view of chela and tibia of palp, female allotype. Scale as in figure 2.

Fig. 6. Portion of fourth pedal tarsus to show types of setae, female allotype. Scale equals 0.05 mm. M, multidenticulate seta; P, pseudotactile seta; A, acuminate seta.

Fig. 7. Chaetotaxy of the genital complex, female allotype. Scale equals 0.1 mm. A, anterior operculum; P, posterior operculum.

edge. Fixed finger with lamina exterior; inner surface of apical tooth bearing three small denticles; inner margin of finger with two well-developed teeth followed proximally by three or four smaller teeth; serrula interior with the four distal plates free and serrate, posterior plates fused to form a velum. Movable finger 0.22 mm. long, serrula exterior composed of 18 ligulate plates; subapical lobe moderately developed; galeal seta not reaching nearly to the tip of the galea; base of galea stout, six well-developed but simple lateral and terminal branches.

Palp: Moderately stout to stout; reddish brown except for the lighter maxilla; coarsely granulate; setae chiefly multidenticulate. Maxilla 0.43 mm. long, 0.29 mm. wide; surface moderately to coarsely granular; numerous scattered acuminate setae. Trochanter coarsely granulate, numerous multidenticulate setae on the interior surface; two weak protuberances; length 0.37 mm., width 0.255 mm. Femur with sculpturing as in the trochanter; setae multidenticulate; pedicle about as long as wide; outer surface greatly swollen, margin weakly convex; inner margin with a concavity in the distal fourth; length 0.685 mm., width 0.255 mm., length 2.7 times the width. Tibia pediculate; outer margin forming an unbroken arc; inner margin medially bulging; sculpturing and chaetotaxy as in the femur except that the setae of the extensor surface are more slender and relatively longer; length 0.64 mm., width 0.29 mm., length 2.2 times the width. Chela stout; weakly granular on inner surface of hand; setae of inner and dorsal surfaces of hand multidenticulate, those of the outer and ventral surfaces longer and paucidenticulate; length of chela 1.17 mm., width 0.505 mm., length 2.3 times the width; length of hand including pedicle 0.67 mm.; depth of chela 0.55 mm.; chela swollen dorsally; fixed finger stout and straight in lateral view, with vestigial venedens and duct; movable finger subequal to the hand without the pedicle, length 0.61 mm., gently curved, functional venedens present. Fixed finger with about 42 marginal teeth, contiguous along almost the entire finger length; three median accessory teeth, separated from one another by little more than the width of the base of the teeth, placed slightly distal to the midpoint of the finger; five lateral accessory teeth (possibly a sixth broken off) dispersed more or less regularly along a little less than the distal one-half of the finger margin. Movable finger with marginal teeth nearly equal in size, number, and position to those of the opposing finger; median accessory teeth three in number and placed as in the fixed finger; lateral accessory teeth six in number and confined to the distal half of the finger. Movable finger with four tactile setae: *t* about one-third (variable) of finger length from tip; *b* and *sb* paired, located in basal one-fourth of finger and separated by less than three areole diameters; *st* near midpoint of finger and closer to *t* than to *sb*. Fixed finger with eight tactile setae: external series with *et* about one-sixth of finger length from tip, *est* proximal to the midpoint of the finger and approximately twice as far from *et* as from *esb*, *esb* about twice as far from *est* as from *eb;* internal series with *it* twice as far from finger tip as *et* is from finger tip, *ist* somewhat more than one-half as far from *it* as the latter is from the finger tip, *ist* somewhat proximal to the midpoint of the finger, *isb* and *ib* paired and slightly distal to the level of the corresponding pair of the external series.

Legs: Moderately stout, yellowish brown, setae varying from multidenticulate to simple acuminate; sculpturing from finely granular on the extensor surface of the trochanter to smooth on the tarsus; heterofemorate; metatarsus wanting; terminal claws entire; subterminal setae simple. Trochanter of first leg 0.15 mm. long, length 1.1 times the depth, several long acuminate setae on flexor surface; pars basilis with numerous slender but variable setae on the convex flexor margin, extensor margin length 0.145 mm., depth 0.15 mm.; pars tibialis with both flexor and extensor margins gently convex, setae multidenticulate, length of extensor margin 0.32 mm., depth 0.13 mm.; tibia weakly S-shaped, flexor margin with acuminate setae, extensor margin with multidenticulate setae, length 0.35 mm., depth 0.1 mm.; tarsus subcylindrical, setae as in the tibia, length 0.35 mm., depth 0.075 mm., length 4.7 times the depth. Fourth leg with chaetotaxy and sculpturing much as in the first leg; trochanter 0.275 mm. long, length 1.85 times the depth; pars basilis 0.23 mm. long, 0.165 mm. deep; pars tibialis 0.45 mm. long, 0.18 mm. deep; entire femur with a convex extensor margin centrally flattened, flexor margin straight, suture between pars basilis and pars tibialis forming an oblique angle with the longitudinal axis of the podomere, length 0.61 mm., depth 0.18 mm., length 3.4 times the depth; tibia weakly S-shaped, length 0.515 mm., depth 0.115 mm., length 4.5 times the depth; tarsus subcylindrical, setae acuminate except along the basal two-thirds of the extensor margin, several long acuminate setae including a pseudotactile seta on extensor margin near the distal end, true tactile seta wanting, length 0.4 mm., depth 0.09 mm., length 4.4 times the depth.

Genital complex: Both posterior and anterior opercula each with about 25 acuminate setae.

FEMALE: In general as in the male;

length 3.1 mm. Posterior disc of carapace with 24, median disc with at least 36, and anterior disc with more than 45 setae; carapace length 0.96 mm., width 0.8 mm. Abdomen with length 2.2 mm., width about 1.5 mm. (abdomen somewhat distorted in preparation); total number of setae in tergites 1 through 10 as follows: 18:18–22:22:24:22:22–24:22–24:20–24:18–20:16–18; total number of setae for each sternite from 4 to 11 as follows: 6–8:12–16 : 26–28 : 28 : 22–24 : 22–24 : 18–20 : 10. Each anterior stigmatic plate with three setae, each posterior plate with one.

Chelicera: Length 0.305 mm., width 0.165 mm., length of movable finger 0.24 mm., serrula exterior with 18 or 19 ligulate plates, otherwise much as in the male.

Palps: Similar to the palp of the male; podomeres except chela with almost the same length:width ratios but slightly larger; maxilla 0.48 mm. long, 0.32 mm. wide; trochanter 0.4 mm. long, 0.29 mm. wide; femur length 0.8 mm., width 0.29 mm.; tibia 0.74 mm. long, 0.32 mm. wide; chela length 1.29 mm., width 0.515 mm., length 2.5 times the width; depth of hand equal to width; length of hand with pedicle 0.79 mm.; movable finger 0.64 mm. long, subequal to hand without the base. Marginal teeth of fixed and movable finger much as in the male. Fixed finger with seven lateral accessory teeth evenly spaced along about the distal half of the finger; medial teeth three in number, with one subterminal in position and the other two removed almost one-fourth of the finger length from the first. Movable finger with nine lateral accessory teeth irregularly placed along somewhat more than the distal one-half of the inner margin of the finger; two medial accessory teeth (possibly a third broken) well separated and placed about one-third of the finger length from the tip. Tactile setae much as in the male except for individual variation.

Legs: Much like those of the male, most podomeres larger but except for tarsi with about the same length:width ratio. First leg with extensor margin of pars basilis of femur with length 0.16 mm., depth 0.175 mm.; pars tibialis 0.35 mm. long, 0.15 mm. deep; tibia 0.385 mm. long, 0.105 mm. deep; tarsus 0.39 mm. long, 0.075 mm. deep, length 5.2 times the depth. Fourth leg with trochanter 0.32 mm. long, 0.19 mm. deep; pars basilis 0.29 mm. long, 0.19 mm. deep; pars tibialis 0.53 mm. long, 0.2 mm. deep; entire femur 0.73 mm. long, 0.2 mm. deep, length 3.65 times the depth; tibia 0.59 mm. long, 0.13 mm. deep; tarsus 0.48 mm. long, 0.09 mm. deep, length 5.3 times the depth, pseudotactile seta with a few subterminal and terminal denticulations.

Genital complex: Anterior operculum with 23 scattered acuminate setae; posterior operculum with 15 acuminate setae arranged in a single row.

TYPE LOCALITY: The male holotype and the female allotype are from a collection bearing the label: "Medicine Hat, Alta.; June, 1930; Carr."

Of all the species assigned by various writers to the genus *Hesperochernes*, *H. montanus* Chamberlin, 1935, described from a bird's nest in Montana seems most closely related to *H. canadensis*. The relationship is shown by the non-denticulate condition of the basal seta of the chelicera, the chaetotaxy of body and palps, the presence of microlyrifissures on the sternites, as well as other characteristics. The two forms differ in many characters including the number of marginal and accessory teeth on the palpal fingers, the branching of the galea, and the length: width ratio of the chela and the fourth pedal tibia.

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NEW SPECIES AND SUBSPECIES OF BIRDS FROM VENEZUELA. 2

BY JOHN T. ZIMMER AND WILLIAM H. PHELPS

This paper is a continuation of "New species and subspecies of birds from Venezuela. 1" (1944, Amer. Mus. Novitates, no. 1270). These novelties have been collected mostly on the high, isolated, sandstone mountains in the Guiana highlands of southern Venezuela, especially on prolific Mt. Ptari-tepui, situated 120 kilometers to the east of Mt. Auyan-tepui.

We wish to make acknowledgment of the aid extended to the junior author, in his identifications, by Messrs. W. E. Clyde Todd of the Carnegie Museum, Boardman Conover of the Chicago Natural History Museum, James L. Peters of the Museum of Comparative Zoölogy, Alexander Wetmore and Herbert Friedmann of the United States National Museum, and Prof. Oscar Neumann.

Unless otherwise stated, the specimens listed as examined are in the collection of the American Museum of Natural History.

Names of colors are capitalized when direct comparison has been made with Ridgway's "Color standards and color nomenclature."

Crypturellus ptaritepui, new species

TYPE: From Mt. Ptari-tepui, southwest slope, Gran Sabana, State of Bolívar, Venezuela; altitude 1700 meters. No. 24957, Phelps Collection, Caracas. Adult male collected July 24, 1944, by Fulvio Benedetti. (Type on deposit at the American Museum of Natural History.)

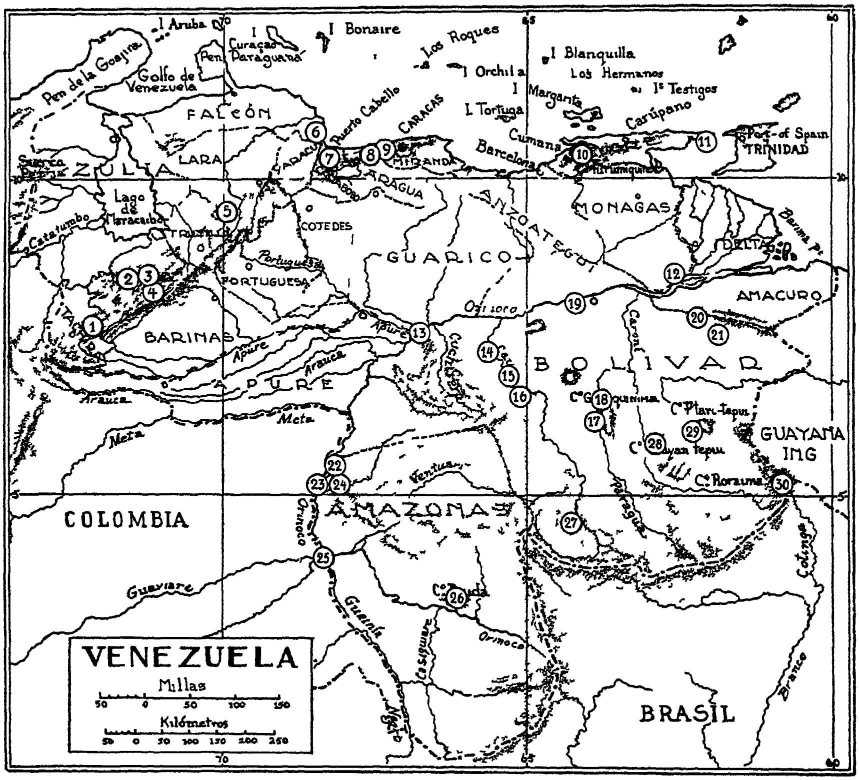
DIAGNOSIS: Nearest to the species *C. obsoletus* but top of head rufous brown instead of dusky; back darker rufous brown; breast, abdomen, and shanks uniform fuscous without barring, instead of rufous with lighter, and barred, abdomen, shanks, and under tail-coverts; tarsi and toes longer. Uropygial feathering very long and decomposed, quite different from that of *obsoletus* though somewhat like that of *berlepschi* which is otherwise distinct.

RANGE: Known only from the southwestern slope of Mt. Ptari-tepui, in the Subtropical Zone, at altitudes of 1350 and 1700 meters.

DESCRIPTION OF TYPE: Top of head, back, and uropygium Carob Brown with a variable rufous tinge, more dusky on forehead; nape and hind neck brightest; sides of head, including lores and supraocular region, chin and throat Light Neutral Gray × Neutral Gray; auriculars uniform with crown; rest of under parts uniform Fuscous with a rufous sheen on the upper breast. Upper surface of primaries Fuscous, passing to Fuscous-Black on secondaries, tertials, and coverts; edgings of tertials and coverts uniform with back; under surface of wings, including posterior under coverts, Hair Brown; anterior coverts Fuscous. Tail Fuscous, slightly edged with rufous. Maxilla (in life) "black"; mandible "yellow, dark tip"; feet "olive"; iris "cream." Wing, 146 mm.; tail, 43; exposed culmen, 25; culmen from base, 30.5; tarsus, 52.

REMARKS: A second specimen, sex undetermined, differs from the type principally in being brighter rufescent, less brownish above and with the rufescent sheen below stronger and more extensive; also the throat is paler gray. Maxilla (in life) "brown"; mandible "bone"; "feet brown"; iris "white." Its measurements are: wing, 153 mm.; tail, 43; exposed culmen, 24; culmen from base, 30; tarsus, 51.

The two specimens were collected in the unburnt forest which extends uninterrupt-



19	Agua Salada de Ciudad Bolívar
21	Altiplanicie de Nuria
30	Arabupu
1	Boca de Monte
13	Caicara
22	Caño Catamapo
24	Caño Cuao
20	Cerro Tomasote
8	Colonia Tovar
11	Cristóbal Colón
4	El Escorial
20	El Palmar
3	El Valle, Mérida
3	Hechicera
23	Isla Ratón
9	Junquito
2	La Azulita
15	La Prisión
15	La Unión
14	La Vuelta
12	Las Barrancas
7	Las Quiguas
7	Las Trincheras
26	Laterite Valley
23	Maipures
4	Mérida
28	Mt. Auyan-tepui
5	Mt. Bucarito
26	Mt. Duida
17	Mt. Guaiquinima
29	Mt. Ptari-tepui
30	Mt. Roraima
16	Nichare River
30	Paulo
30	Phillipp Camp
1	Pregonero
3	Quintero
18	Río Tonoro
30	Rondón Camp
27	Sabana Canaracuni
7	San Esteban
10	San Félix, Sucre
25	San Fernando de Atabapo
23	Sanariapo
14	Suapure
6	Tucacas

edly from the foot of Mt. Ptari-tepui to the base of the upper cliffs at 2100 meters.

SPECIMENS EXAMINED

C. ptaritepui.—VENEZUELA (Phelps Collection): Mt. Ptari-tepui, 1♂ (type), 1700 meters; 1 (?), 1350 meters.

C. obsoletus obsoletus.—BRAZIL: Roca Nova, Paraná, 1 ♂, 1 ♀; Taguara, Mundo Novo, 1 ♂; Victoria, São Paulo, 2 ♂, 1 ♀; Rio Jordão, Araguary, Minas, 3 ♂. ARGENTINA: Pasadas, Misiones, 1 ♂.

C. o. punensis.—BOLIVIA: Locotal, Prov. Cochabamba, 3 ♂; Incachaca, Cochabamba, 1 ♀.

C. o. ochraceiventris.—PERÚ: Cushi Libertad, 1 ♂, 1 ♀.

C. o. castaneus.—ECUADOR: Río Suno, above Avila, 1 ♂; Cerro Galeras, 1 ♂, 1 ♀, 1 ♂ [juv.]. PERÚ: Uchco, Chachapoyas, 1 ♀.

C. o. cerviniventris.—VENEZUELA (Phelps Collection): Colonia Tovar, 1 ♂; Junquito, 1 ♀. VENEZUELA (Conover Collection): La Azulita, 1 ♂.

Synallaxis cabanisi griseipectus, new subspecies

TYPE: From Mt. Ptari-tepui, Gran Sabana, State of Bolívar, Venezuela; altitude 1800 meters. No. 24960, Phelps Collection, Caracas. Adult male collected July 27, 1944, by Fulvio Benedetti. (Type on deposit at the American Museum of Natural History.)

DIAGNOSIS: Nearest to *S. c. macconnelli*, of Mt. Roraima, but breast, sides, and abdomen grayer, less brownish, and back darker, more sooty, olivaceous.

RANGE: Known only from the southwestern slope of Mt. Ptari-tepui, in the Subtropical Zone, at altitudes from 1700 to 1900 meters.

DESCRIPTION OF TYPE: Top of head and nape Burnt Sienna × Sanford's Brown; back and uropygium Brownish Olive; sides of head, including ear-coverts, dark gray, the lores mixed with whitish. Chin and throat blackish, the feathers edged with whitish giving a squamulated appearance; breast, sides, and under tail-coverts Deep Mouse Gray × Dark Olive Gray; belly noticeably paler. Wings Fuscous Black, the outer vanes of remiges narrowly edged with Hazel, basal on the outer ones and increasing in extent inwardly; upper wing-coverts and scapulars Burnt Sienna × Sanford's Brown, uniform with top of the head; bend of wing, under wing-coverts, and axillaries dark buffy. Tail above Chestnut × Bay with brownish black shafts and with the color of the back invading the margins of the rectrices; below Tawny × Russet with Pinkish Cinnamon shafts. Maxilla (in life) "black"; mandible "gray, with black tip"; feet "gray"; iris "chestnut." Wing, 60 mm.; tail, 72; exposed culmen, 13; culmen from base, 16; tarsus, 22.

REMARKS: Sexes alike. Size similar to *macconnelli*. Range of measurements: four males: wing, 60, 61, 61, 60 mm.; tail, 72, 73, 70, 67; culmen from base, 16, 15, 16.5, 15.5; three females: wing, 56, 61, 59; tail, 65, 66, 65; culmen from base, 16, 16, 15.5.

SPECIMENS EXAMINED

S. c. cabanisi.—PERÚ: Tulumayo, Prov. Junín, 2 ♂, 2 ♀, 1 (?); La Pampa, 1 ♂; Lagarto, Alto Ucayali, 3 ♂, 3 ♀.

S. c. flaviventris.—BOLIVIA: Todos Santos, Río Chaparé, 1 ♂, 1 ♀.

S. c. macconnelli.—VENEZUELA: Mt. Roraima, 5 ♂, 2 ♀. VENEZUELA (Phelps Collection): Arabupu, 3 ♂.

S. c. griseipectus.—VENEZUELA (Phelps Collection): Mt. Ptari-tepui, 4 ♂ (including type), 3 ♀.

Grallaria griseonucha tachirae, new subspecies

TYPE: From Boca de Monte, Pregonero, State of Táchira, Venezuela; altitude 2300 meters. No. 24556, Phelps Collection, Caracas. Collected December 10, 1943, by Fulvio Benedetti. (Type on deposit at the American Museum of Natural History.)

DIAGNOSIS: Differs from *Grallaria g. griseonucha* in having the crown, back, wings, and tail less rufous, more brownish olive; below lighter rufous; belly more buffy, less rufous; throat noticeably lighter than breast, not uniform as in *griseonucha*.

RANGE: Known only from the type locality, in the Subtropical Zone, at altitudes between 2300 and 2400 meters.

DESCRIPTION OF TYPE: Forehead, lores, area above and below the eyes, above the auriculars, and nape Slate Color; crown Medal Bronze; back Brussels Brown; rump more olivaceous; upper tail-coverts

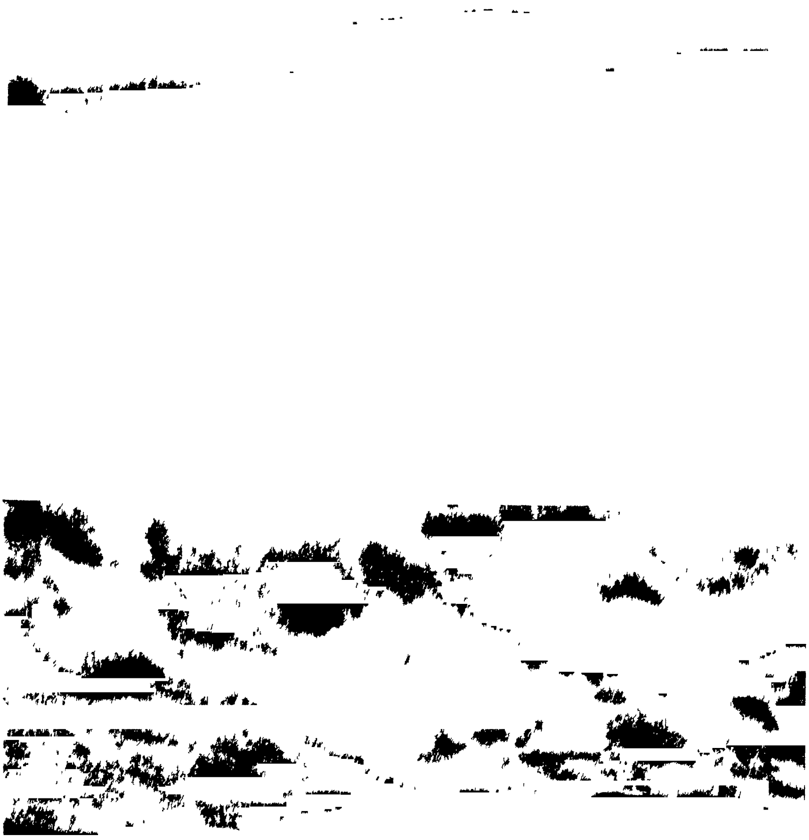


Fig 1 Mt Ptari-tepui from the south Upper figure taken from the 1000-meter level, lower figure from the 1200-meter level, looking past Mt Sororopan-tepui.

rufous; a narrow pale rufous collar between nape and back. Breast light Amber Brown, throat lighter; auriculars darker; abdomen and under tail-coverts near Light Ochraceous-Buff. Wings Fuscous, the outer vanes of primaries uniform with the back; margins of the secondaries and all of the tertials, and broad edgings on upper wing-coverts darker and more rufescent; under wing-coverts and axillaries uniform with under parts. Upper surface of tail Sanford's Brown × Auburn; under surface brownish olive. Bill (in life) "slaty-black"; feet "slaty-black"; iris "brown." Wing, 85 mm.; tail, 36; exposed culmen, 17; culmen from base, 22; tarsus, 47.

REMARKS: Size similar to *griseonucha.* Sexes alike. The two males of the new race measure: wing, 85, 87 mm.; tail, 36, 38; exposed culmen, 17, 17.5; culmen from base, 22, 22.5; tarsus, 47, 47. The female measures: wing, 86; tail, 38; exposed culmen, 19; culmen from base, 23; tarsus, 45.

This is one of the few cases where two races are represented within the Mérida avifaunal region. The known range of *G. g. griseonucha* is 100 kilometers to the northeast, and the new race is separated from the *griseonucha* range by the valley of the Chama River, although the Subtropical Zone is continuous around the headwaters of that river.

SPECIMENS EXAMINED

G. g. griseonucha.—VENEZUELA: El Valle, 2 ♂, 2 ♀; El Escorial, 1 ♀; Hechicera, 1 ♂; "Mérida," 1 (?), 1 (?) [juv.]. VENEZUELA (Phelps Collection): Quintero, 1 ♂; El Escorial, 1 ♀.

G. g. tachirae.—VENEZUELA (Phelps Collection): Boca de Monte, Pregonero, Táchira, 2 ♂ (including type), 1 ♀.

Platyrinchus mystaceus imatacae,
new subspecies

TYPE: From Cerro Tomasote, El Palmar, Imataca Mountains, State of Bolívar, Venezuela; altitude 500 meters. No. 17913, Phelps Collection, Caracas. Adult male collected April 4, 1942, by Fulvio Benedetti. (Type on deposit at the American Museum of Natural History.)

DIAGNOSIS: This form has the under parts the palest of all the races of *mystaceus.* Closest to *P. m. insularis* but paler below, the breast more yellowish buff, less brownish, and abdomen more yellowish white, less buffy; outer edges of remiges paler.

RANGE: Known only from the type locality at the northern end of the Imataca range of mountains at altitudes between 500 and 600 meters.

DESCRIPTION OF TYPE: Above Buffy Olive, a slightly dusky tinge to the top of the head; concealed crown patch Lemon Chrome; a long superciliary stripe, reaching to the nostril and continuous with a circumocular ring, Light Buff; malar streak and auricular patch dusky with the basal portion of the auriculars deep buff, forming a light patch in the center of the dark area. Chin and throat white with a slight yellow tinge, narrowly bordered laterally by buff; sides and a wash across the breast Chamois; abdomen, under tail-coverts, and bend of wing Colonial Buff; shanks dusky. Wings Clove Brown with Buffy Citrine edgings to the remiges and upper wing-coverts; tips of greater and median coverts brighter, forming two weak wing bars; under wing-coverts buff, mottled with dusky; axillaries whitish. Rectrices Clove Brown with Buffy Citrine edgings. Maxilla (in life) "black"; mandible "flesh"; feet "light flesh"; iris "brown." Wing, 53 mm.; tail, 25; exposed culmen, 9.5; culmen from base, 14; tarsus, 18.

REMARKS: Sexes alike. Size similar to *P. m. insularis.* Range of measurements: two males: wing, 53, 53 mm.; tail, 25, 28; culmen from base, 14, 13.5; four females: wing, 48, 49, 48, 49; tail, 25, 24, 24, 23; culmen from base, 13, 13, 13, 13.5.

Ninety kilometers to the north, at Las Barrancas, *insularis* has been recorded, which race, apparently, in the Orinoco basin, is confined to the banks of the Orinoco River as far up as Caicara. The Imataca range of mountains, where the new race has been found, extends from 50 kilometers northwest of Cerro Tomasote, the type locality, 170 kilometers toward the southeast to the borders of British Guiana north of the Cuyuni River. Altitudes in this range of mountains are not above 1000 meters.

Specimens Examined

P. m. mystaceus.—Brazil: (Rio de Janeiro, Monte Serrat, Maceiras, São Paulo, Piquete, Victoria, Fazenda Caycá, Paraná, "Bahia," "Brazil," Matto Grosso-Campanario, Rio Amambary), 20.

P. m. bifasciata.—Brazil: Matto Grosso, Chapada, 13; Urucum, 1 ♀.

P. m. zamorae.—Perú: 6. Ecuador: (Zamora, upper Sumaco, below San José, Baeza, Sabanilla, "Equateur"), 11.

P. m. albogularis.—Ecuador: (Esmeraldas, Chimbo, Río Chimbo, Gualea, Paramba, Naranjo, Zaruma, Mindo, San Nicolas), 17.

P. m. insularis.—Tobago: 7. Trinidad: 12. Venezuela: Mt. Bucarito, 1 ♂, 1 ♀; Tucacas, 1 ♂, 1 ♀ 1 (?); Las Trincheras, 1 ♂; San Esteban, 1 ♂; Las Quiguas, 1 ♂; San Félix, Sucre, 1 ♀; Cristóbal Colón, 1 ♂, 1 ♀; Las Barrancas, 2 ♂, 1 ♀; Agua Salada de Ciudad Bolívar, 1 ♀; Caicara, 1 ♂, 1 ♀.

P. m. imatacae.—Venezuela (Phelps Collection): Cerro Tomasote, El Palmar, Bolívar, 2 ♂ (including type), 4 ♀.

P. m. duidae.—Venezuela: Mt. Duida, Laterite Valley, 1 ♂; Mt. Roraima, Paulo, 1 ♂; Arabupu, 2 ♀; "Roraima," 1 ♀.

P. m. neglectus.—Colombia: (Las Lomitas, La Candela, Río Frío, Palmira, Primavera), 6. Panamá: 26. Costa Rica: (Azahar de Cartago, La Estrella, Bonilla, Navarrito, Aquinares, Los Reyes), 11.

P. m. dilutus.—Costa Rica: (Bebedero, Las Cañas), 6. Nicaragua: (Volcan de Chinandega, Muy Muy), 8.

P. m. cancrominus.—Nicaragua: (Río Coco, Ocotal, Uluce, Matagalpa, Savala, Tuma), 8. Guatemala: 9.

Troglodytes rufulus fulvigularis, new subspecies

Type: From Mt. Ptari-tepui, Gran Sabana, State of Bolívar, Venezuela; altitude 1800 meters. No. 24945, Phelps Collection, Caracas. Adult female collected July 23, 1944, by Fulvio Benedetti. (Type on deposit at the American Museum of Natural History.)

Diagnosis: Nearest to *T. r. rufulus* of Mt. Roraima, but chin, throat, and breast darker, more rufous, less whitish; above averaging darker.

Range: Mts. Ptari-tepui and Auyan-tepui, in the Subtropical Zone, at altitudes between 1750 and 2200 meters.

Description of Type: Head, back, uropygium, lores, and postocular region Auburn; auriculars darker; streak above eye and auriculars light Tawny. Chin, throat, and upper breast deep Cinnamon, merging into the Argus Brown of sides, shanks, lower abdomen, and under tail-coverts. Wings Fuscous-Black, outer vanes of remiges finely barred with buff, becoming more rufous on tertials where the barring is on both vanes; upper wing-coverts heavily edged with Auburn uniform with the back; under wing-coverts dusky, edged with Argus Brown. Tail Argus Brown above, paler below, finely barred with dusky. Maxilla (in life) "black"; mandible "horn"; feet "black"; iris "brown." Wing, 55 mm.; tail, 38; exposed culmen, 14.5; culmen from base, 19; tarsus, 23.

Remarks: Sexes alike. Size similar to *T. r. rufulus.* Range of measurements: five males: wing, 55–57 (56) mm.; tail, 38–39 (38.4); culmen from base, 18–19 (18.6); three females: wing, 56, 55, 56; tail, 38, 36, 36; culmen from base, 18, 18, 18.

Chapman in "The upper zonal birds of Mt. Auyan-tepui, Venezuela" (1939, Amer. Mus. Novitates, no. 1051, p. 10) calls attention to the difference between the Mt. Auyan-tepui birds and those of Mt. Roraima. He says: "The breast in these nine specimens averages somewhat more rufescent than in a large series of *rufulus* from Roraima; in other respects they are alike." The Mt. Ptari-tepui specimens have still darker throats and breasts, so the Mt. Auyan-tepui population is intermediate but nearer to the new form.

Specimens Examined

T. r. rufulus.—Venezuela: Mt. Roraima, 4 ♂, 4 ♀, 1 (?); summit of Roraima, 2 ♂, 2 ♀; Rondón Camp, 9 ♂, 1 ♂ juv., 4 ♀, 2 ♀ juv.; Phillipp Camp, 9 ♂, 5 ♂ juv., 6 ♀.

T. r. duidae.—Venezuela: Mt. Duida, many localities from 3250 to 7100 feet, 19 ♂, 25 ♀, 5 (?).

T. r. fulvigularis.—Venezuela (Phelps Collection): Mt. Ptari-tepui, 1750–2000 meters, 5 ♂, 3 ♀ (including type). Venezuela: Mt. Auyan-tepui, 2200 meters, 4 ♂, 3 ♀.

Myioborus cardonai, new species

Type: From Mt. Guaiquinima, Paragua River, State of Bolívar, Venezuela; altitude 1220 meters. No. 22762, Phelps Collection, Caracas. Adult, sex undetermined, collected October 5, 1943, by Felix Cardona. (Type on deposit at the American Museum of Natural History.)

Diagnosis: Differs from all the known subspecies of *M. melanocephalus* of Bolivia, Perú, and Ecuador by having the white on the rectrices more restricted; under parts dark orange instead of yellow; supraloral streak and circumocular ring white instead of yellow and not extending across forehead at base of bill; and nape, back, and rump washed with olive brown instead of being uniform gray. Differs from the various subspecies of *M. brunneiceps* by having the crown black instead of chestnut; the back darker and less brownish; the white circumocular ring broader and more complete; the white on the rectrices about as in *M. b. duidae* (less than in the other subspecies), but under parts even deeper orange than in that form.

Range: Known only from the type locality.

Description of Type: Top of head black; nape, back, and rump brownish olive, bases of feathers gray; upper tail-coverts uniform with rump but tipped with blackish; lores black; supraloral stripe and circumocular ring white, interrupted by the black lores; malar and postocular regions, ear-coverts, and sides of neck grayish. Point of chin grayish; throat, breast, sides, and abdomen Orange × Cadmium Orange; under tail-coverts white. Wings Fuscous-Black, the upper coverts slightly margined with the brownish olive of the back; under wing-coverts gray, tipped with whitish. Tail black; outermost rectrices white except the very base of the outer vane, the basal half of the inner vane, and a narrow inner margin extending well toward the tip; second rectrices black with an elongated white patch crossing the shaft on terminal third, with a white streak running basad along the outside of shaft; third rectrices with only a small terminal shaft spot on inner vane. Bill (in dried skin) black; feet brown. Wing, 63 mm.; tail, 59; exposed culmen, 10; culmen from base, 14; tarsus, 19.5.

Remarks: Range of measurements: three (?): wing, 63, 57, 61 (60.3) mm.; tail, 59, 55, 61 (58.3); culmen from base, 14, 13, 12.5 (13.2); tarsus, 19.5, 19.5, 19.5, (19.5). Measurements of three males of *M. m. melanocephalus:* wing, 68, 68, 68 (68); tail, 64, 62, 62 (62.7); culmen from base, 12, 13, 13 (12.7); tarsus, 20.5, 19.5, 19.5 (19.8). Thus in size the two species are similar except that the new species has an 11 per cent shorter wing.

It is possible that this new bird, known only from an isolated mountain, is only subspecifically distinct from *melanocephalus* or *brunneiceps*, or that all three should be considered conspecies. Certain questions of distribution require further study before any positive conclusions can be reached. In the meantime the bird is given a specific name.

The species is named after Captain Felix Cardona, noted explorer and cartographer of the upper reaches of the Caroní, Paragua, Caura, and Ventuari rivers.

Specimens Examined

M. cardonai.—Venezuela (Phelps Collection): Mt. Guaiquinima, 1220 meters, 3 (?) (including type).

M. melanocephalus bolivianus.—Bolivia: Incachaca, Prov. Cochabamba, 3 ♂, 12 ♀.

M. m. melanocephalus,—Perú: (Inca Mines, Leimebamba, Chachapoyas, Santo Domingo, "N. Perú"), 8.

M. m. griseonuchus.—Perú: El Tambo, 1 (?).

M. m. bairdi.—Ecuador: 65.

M. brunneiceps brunneiceps.—Bolivia: (Chilon, Prov. Santa Cruz; Pulque, Parotani, Prov. Cochabamba; Tujma, Prov. Cochabamba, Río Cachimayo, Prov. Sucre), 14. Argentina: 19.

M. b. castaneocapillus.—Venezuela: Mt. Roraima, 26; Mt. Auyan-tepui, 9. British Guiana: Mt. Twek-quay, 1.

M. b. duidae.—Venezuela: Mt. Duida, 75.

Tachyphonus cristatus orinocensis,
new subspecies

Type: From Sanariapo, middle Orinoco River, Territorio Amazonas, Venezuela; altitude 130 meters. No. 21383, Phelps Collection, Caracas. Adult female collected February 18, 1943, by Fulvio Benedetti. (Type on deposit at the American Museum of Natural History.)

Diagnosis: The female differs from that sex of *T. c. cristatus* of French Guiana and northeastern Brazil by having the forehead, sides of crown, and sides of head dark gray instead of light buffy brown; the crown much deeper rufous; the back dark rufous brown instead of light yellowish brown, and the rump rufescent rather than ochraceous. The female differs from that of *cristatellus* of the Bogotá region by having the abdomen paler, more yellowish, less ochraceous orange, the throat paler, and the upper parts browner, less reddish. The male differs from that of *cristatus* by having the crest more scarlet, less orange, being closer to *cristatellus* in this respect.

Range: Lower Paragua River, upper and lower Caura River, and the Orinoco River from Caño Cataniapo up to San Fernando de Atabapo.

Description of Type: Forehead and sides of crown Hair Brown × Deep Mouse Gray, paler on lores, sides of face, and ear-coverts; center of crown Amber Brown × Argus Brown; back dark Brussels Brown; uropygium Sudan Brown. Throat Cream-Buff, upper breast more grayish; lower breast Ochraceous-Buff × Antimony Yellow; sides, abdomen, and under tail-coverts deeper, reaching Ochraceous-Orange × Ochraceous-Tawny on the under tail-coverts. Wings Fuscous × Fuscous-Black; remiges narrowly edged with Prout's Brown; outer edgings of greater upper coverts uniform with the back; bend of wing buffy; under wing-coverts and axillaries whitish. Upper surface of rectrices brownish, the outermost ones lighter, all with narrow and faint suggestions of darker bars; lower surface Tawny-Olive × Saccardo's Umber; shafts dark brown above, whitish below. Maxilla (in life) "black"; mandible "flesh, black tip"; feet "black"; iris "brown." Wing, 73 mm.; tail, 67; exposed culmen, 12; culmen from base, 16; tarsus, 19.

Remarks: Description of male (No. 22145, Phelps Collection): Almost entirely black except center of crown which has a crest 8 mm. wide, Grenadine Red, edged anteriorly and laterally with Warm Buff; rump Antimony Yellow; gular patch deep Ochraceous-Buff, 3 mm. wide; a hidden white patch on shoulders; remiges Fuscous; outer under wing-coverts black, inner ones white; axillaries white. Maxilla (in life) "black"; mandible "base gray, tip black"; feet "black"; iris "brown." Wing, 77 mm.; tail, 64; exposed culmen, 13; culmen from base, 16.5; tarsus, 18.

Size similar to *T. c. cristatus*. Range of measurements: eight females: wing, 68–73 (70.2)mm.; tail, 58–67 (63.2); culmen from base, 16–16.5 (16.3).

Chapman, in his "Descriptions of new birds from Ecuador and Perú" (1925, Amer. Mus. Novitates, no. 187, p. 9), referring only to males, called attention to the fact that the Orinoco population was different. He said: "I am unable to separate eastern Ecuador specimens from our very small series of Cayenne birds. Orinoco examples, however, have a larger bill, smaller, redder crest, and more buff on the head. They are apparently separable but without comparison with 'Bogotá' material (*cristatellus* Sclater) it seems unwise to name them."

Specimens Examined

T. c. cristatus.—French Guiana: Pied Saut, 1 ♂, 1 ♀; Approuague River, 1 ♀; Mana River, 1 ♂; "Cayenne," 2 ♂, 1 ♂ [juv.]. French Guiana (Carnegie Museum): 4 ♀. French Guiana (Museum of Comparative Zoology): Tamanoir, 1 ♀; Pied Saut, 1 ♀.

T. c. intercedens.—Dutch Guiana: Paramaribo, 1 ♂; "Interior of Surinam," 1 ♂, 1 ♂ juv. British Guiana: Tumatumari, 2 ♂, 5 ♀; Bartica Grove, 3 ♂; Rockstone, 1 ♂; Potaro Landing, 1 ♂; "Br. Guiana," 1 ♂; "Demarara," 1 ♂. Venezuela: Mt. Auyan-tepui, 2 ♂, 2 ♀. Venezuela (Phelps Collection): Mt. Auyan-tepui, 1 ♀; Altiplanicie de Nuria, Sierra de Imataca, 1 ♀.

T. c. orinocensis.—Venezuela: Lower Caura, Nichare River, 3 ♂; Suapure, 7 ♂, 1 ♂ juv., 3 ♀; La Prisión, 1 ♂; La Unión, 2 ♂; La Vuelta, 1 ♂; Río Orinoco, Maipures, 1 ♂; foot of Mt. Duida, 1 ♂ [juv.]. Venezuela (Phelps Collection): Río Paragua, Río Tonoro, 1 ♂, 1 ♂ [juv.]; upper Caura, Sabana Canaracuni, 1 ♂; middle Orinoco, Caño Cataniapo, 3 ♂, 2 ♀; Sanariapo, 2 ♂, 1 ♀ (type); Isla Ratón, 1 ♀; Caño Cuao, 1 ♂, 1 ♀; San Fernando de Atabapo, 4 ♂, 3 ♀.

T. c. cristatellus.—Colombia: "Bogotá," 2 [♂], 3 [♀].

T. c. huarandosae.—3 ♂ (including type).

T. c. madeirae.—Brazil: Matto Grosso, Barão Melgaço, 1 ♂, 1 ♀; Roosevelt River, 1 ♂; Obidos, 2 ♂; Calamá, Rio Madeira, 4 ♂ (including type); Rio Madeira, 1 ♂.

T. c. brunneus.—Brazil: Bahia, 2 ♂; "Bahia skin," 2 ♀; Pará, 1 ♂; Igarapé-Attú, Pará, 2 ♂; Peixe-Boi, 1 ♂; Boim, Rio Tapajoz, 1 ♀; Baião, Rio Tocantins, 1 ♀; São Sebastião, São Paulo, 4 ♂, 1 ♀; São Lourenço, Pernambuco, 2 ♂; "S. Brazil," 1 ♂; "Brazil," 1 ♀.

Mitrospingus oleagineus obscuripectus, new subspecies

TYPE: From Mt. Ptari-tepui, Gran Sabana, State of Bolívar, Venezuela; altitude 1600 meters. No. 24948, Phelps Collection, Caracas. Adult male collected July 27, 1944, by Fulvio Benedetti. (Type on deposit at the American Museum of Natural History.)

DIAGNOSIS: Differs from *M. o. oleagineus* of Mt. Roraima in Venezuela and of Mt. Twek-quay in British Guiana, by having the breast, sides, and flanks darker, more olivaceous, less yellowish; belly duller, more greenish yellow.

RANGE: Known only from the southwestern slope of Mt. Ptari-tepui, in the Subtropical Zone, at altitudes between 1250 and 1800 meters.

DESCRIPTION OF TYPE: Crown, back, and uropygium Citrine × Orange-Citrine; forehead, rest of head, and upper breast Slate-Gray, paler on the throat; breast, sides, and flanks Orange-Citrine × Citrine, lighter and more yellowish on middle line of abdomen; under tail-coverts golden brown. Wings Blackish Mouse Gray; primaries and primary-coverts narrowly edged with gray on the outer webs; secondaries, tertials, and rest of upper wing-coverts heavily edged with the citrine of the back; under wing-coverts and axillaries grayish, narrowly edged with citrine; inner webs of remiges basally paler. Tail Blackish Mouse Gray above with somewhat lighter gray margins, paler below; upper aspect of shafts black, lower aspect whitish. Maxilla (in life) "black"; mandible "gray"; feet "gray"; iris "brown." Wing, 94 mm.; tail, 86; exposed culmen, 19.5; culmen from base, 22.5; tarsus, 26.

REMARKS: Sexes alike. Size similar to *M. o. oleagineus.* One other male measures: wing, 91 mm.; tail, 84; culmen from base, 21.5; tarsus, 26. One female: wing, 91; tail, 82; culmen from base, 21; tarsus, 25.5. One (?): wing, 96; tail, 86; culmen from base, 21; tarsus, 25.5.

This species was not collected by the Phelps-Venezuelan Expedition on Mt. Auyan-tepui, 120 kilometers to the west; nor was the species *Pipreola whitelyi.* This was perhaps due to the fact that, on the explored part of Mt. Auyan-tepui, the subtropical forest above 1100 meters was burnt over and destroyed, except for a very small patch of woods on the summit plateau at 1850 meters.

SPECIMENS EXAMINED

M. o. oleagineus.—VENEZUELA: Mt. Roraima, 1 (?); Paulo, 1 ♀; Arabupu, 1 ♂, 1 ♀. VENEZUELA (Phelps Collection): Arabupu, 2 ♂.

M. o. obscuripectus.—VENEZUELA (Phelps Collection): Mt. Ptari-tepui, 2 ♂ (including type), 1 ♀, 1 (?).

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THREE NEW SPECIES OF ENDOMYCHIDAE (COLEOPTERA)

BY H. F. STROHECKER[1]

Recently I borrowed a number of Endomychidae from the American Museum of Natural History. In the lot sent me were representatives of three species as yet undescribed. One of these, from Formosa, is referable to the oriental genus *Indalmus* Gerstaecker; the other two fall in the characteristically Neotropical genus *Amphix* De Castelnau. The holotypes and allotypes are in the American Museum of Natural History; paratypes, where available, are in the collection of the author.

Indalmus formosanus, new species

Figures 1–3

HOLOTYPE: Male. Length, 5 mm.

CHARACTERS OF *Indalmus:* Antennae with club distinct but not much enlarged or flattened, joint 3 twice as long as joint 4; prosternum very narrow between the front coxae but visible from below; mandible with aciculate apex and short, subapical, internal tooth.

Elongate in outline, subparallel, the elytra broadening to behind their middle, moderately convex. Head with a depression internal to each antennal prominence, coarsely and closely punctured, the midline smoother. Pronotum with a prominent stridulatory membrane at the middle of its front margin, its sides somewhat convergent to the short, acutely rounded front angles. Hind angles not divergent but somewhat acute due to the curve of the posterior margin. Lateral sulci of pronotum deeply and sharply impressed, reaching about to middle of disc. Basal transverse sulcus distinct. The entire pronotum is rather closely punctured, the punctures large at the sides, smaller toward the middle but everywhere coarse. Scutellum transverse and with a transversely oval, central impression. Elytra with umbones fairly prominent, the lateral area almost vertical, margin wide (for the genus). The entire upper surface of the elytra is coarsely and closely punctured, the punctures especially large on the lateral areas of the disc. Tibiae and femora with closely set, coarse, setigerous punctures. Front tibia with a short, broad, internal tooth below its middle. Middle tibia strongly incurved at tip. Hind tibia straight.

COLORATION: Head, legs, antennae, disc of thorax, and elytra black; sides of thorax and entire under surface reddish. Each elytron is ornamented with two irregular, transverse, yellow marks, the first behind the umbo, the second and larger at its posterior third. The anterior mark is deeply constricted at its middle; the posterior mark is lunate (the concavity posterior), its outer end prolonged forward as a broad triangle.

ALLOTYPE: Female. Length, 5 mm.

Similar in all features to the male holotype except for the front and middle tibiae, which are straight. The last ventral segment is different in the two sexes, of course, but shows in neither sex any features peculiar to this species.

TYPE MATERIAL: Holotype, male, and allotype, female, Formosa, Sauter Coll. Paratypes: one male and one female, same data.

This may be the insect reported by Ohta in 1931[2] as *Indalmus indicus* (Gorham). *I. indicus* has the elytra black, each with a single, quadrate, reddish mark near the shoulders, and is less coarsely punctured than *formosanus*.

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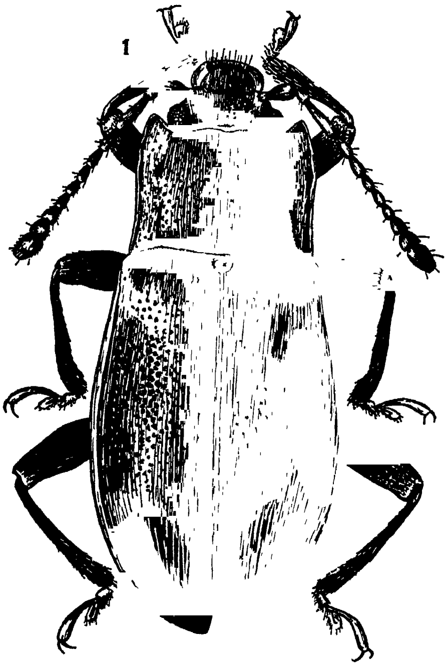
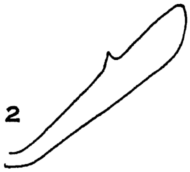
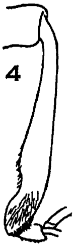
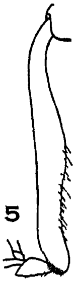
[1] Kenyon College, Gambier, Ohio.

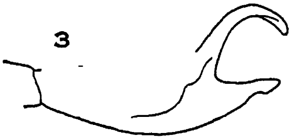
[2] Jour. Fac. Agr. Sapporo (Hokkaido Imp. Univ.), vol. 30, pp. 205–242.

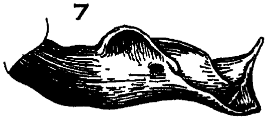












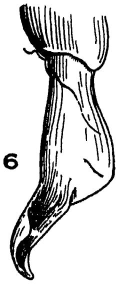


Fig. 1. *Indalmus formosanus*, new species, holotype.
Fig. 2. Idem, front tibia of holotype (from below).
Fig. 3. Idem, aedeagus of paratype.
Fig. 4. *Amphix sinuatipes*, new species, middle tibia of holotype.
Fig. 5. Idem, hind tibia of holotype.
Fig. 6. Idem, aedeagus of holotype.
Fig. 7. *Amphix csikii*, new species, aedeagus of holotype.

Amphix sinuatipes, new species

Figures 4–6

Holotype: Male. Length, 8 mm.

Form typical for the genus, the elytra very convex, highest at about the middle of their length. The present species belongs to that section of the genus in which the elytral margin is broad and flat and has a row of very deep, crater-like punctures. Front tibia straight; middle tibia with the distal emargination deeper than is usual in males of the genus; hind tibia undulate, broadest near its middle. First abdominal sternite with a ridge-like tubercle at midline near the hind margin. Last abdominal sternite truncate posteriorly and with a large callosity on each side of midline.

Coloration: Head, first two joints of antennae, femora and under surface, scutellum and margin of elytra (including umbo and half of front margin) red. Tibiae and last nine joints of antennae black. Elytra deep blue-green, shining, bearing (as is usual in the genus) larger, widely spaced punctures with minute punctures in the interstices.

Type Material: Holotype, male, Rio Santiago, Peru, November 21, 1928 (H. Bassler). Paratype, one male, Achinamiza, Peru, November 20, 1927 (H. Bassler).

The male paratype is identical with the type except in elytral color which is more blue-black than green. I have associated no females with these two specimens.

The character of the hind tibia will serve to distinguish males of this species from those of any yet described species, except *Amphix laetus* (Bates). In color pattern and structure of the aedeagus the two species are also close. The most marked and readily observable difference is the puncturation of the elytra. In *laetus* the punctures are relatively few, irregularly placed and very large, giving the elytra a rugose appearance. In *sinuatipes* the punctures are more numerous, more evenly spaced and finer, and the elytra do not appear at all rugose.

Amphix csikii, new species

Figure 7

HOLOTYPE: Male. Length, 8 mm.

This species, like the preceding, has the elytral margin broad and flat and with a row of crater-like punctures. Form typical for the genus. Front and hind tibiae straight; middle tibia with the usual distal, internal emargination. First abdominal sternite with a patch of long hairs at its middle. Last abdominal sternite approximately truncate and bearing long setae, which are directed posteriorly and toward the midline.

COLORATION: Head, pronotum, first two antennal joints, scutellum, femora, and under surface red. Tibiae and last nine joints of antennae black. Elytra blue-black, weakly shining, with the usual larger and minute punctures.

ALLOTYPE: Female. Length, 8 mm.

Entirely like the male holotype except for the middle tibia, which is not notched, and the first and last abdominal sternites, which lack the patches of long hairs. The last abdominal sternite is broadly rounded.

TYPE MATERIAL: Holotype, male, Achinamiza, Peru, October 30, 1927 (H. Bassler). Allotype, female, Achinamiza, Peru, November 13, 1927 (H. Bassler). Paratype, one female, Rio Santiago, Peru, November 15, 1928.

In coloration and the discal puncturation of the elytra, *csikii* is very similar to *subcordatus* (Gerstaecker) and *elegans* (Csiki) but belongs to a different section of the genus and is easily distinguished from these species by the breadth and the great punctures of the elytral margin.

The species is dedicated to Erno Csiki of the Hungarian Museum.

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NOTES ON MOUNTAIN MIDGES (DEUTEROPHLEBIIDAE) WITH A DESCRIPTION OF THE IMMATURE STAGES OF A NEW SPECIES FROM COLORADO[1]

BY ROBERT W. PENNAK[2]

While studying the bottom fauna of two northern Colorado mountain streams during August, 1944, several graduate students in one of the writer's classes collected larval and pupal stages of one of the least-known and most unusual families of Diptera, the Deuterophlebiidae, or mountain midges. Subsequent searching by the writer has shown that these bizarre aquatic forms are widely distributed, though not abundant, in northern Colorado.

An examination of the literature reveals that the only North American record of this family is a sketchy description and photograph (Muttkowski, 1927) based on a single larva from the Yellowstone River, Wyoming. However, several species, all belonging to the genus *Deuterophlebia*, have been more completely described from Japan and from a wide area on the Asiatic mainland. Although the Colorado specimens belong to the same genus, they undoubtedly represent a new species.

Deuterophlebia coloradensis,
new species

LARVA

GENERAL LARVAL CHARACTERISTICS: The larvae are quite similar to those of other species. The general body shape is plano-convex. The head is free, distinct, flat, and wide, with long branched antennae. The thoracic segments are all distinct and separated by lateral incisions. The abdomen consists of eight distinct segments, the fourth being slightly the widest. Each of the first seven segments bears a pair of large, stout, lateral prolegs supplied with numerous rings of minute claws at the ends. The last abdominal segment is provided with two tapered, terminal processes and five shorter, soft, rounded lobes. There are no stigmata. The dorsal surface of the entire body, including prolegs, is covered with a very fine dense pubescence. Coloration ranges from light to dark brownish, although the head is almost blackish because of greater sclerotization. Twelve well-extended mature larvae were collected, the length range being 3 to 4.5 mm., and the average being 3.9 mm.

HEAD: The head is rather flat and slightly wider than long. The unique branched antennae are long and originate on large tubercles. The proximal segment is stout, roughly cylindrical, and about four times as long as wide. The short ventral branch is cylindrical, blunt, and about as long as the proximal segment. The dorsal branch gradually tapers to a point and is just twice as long as the ventral. Both branches are only slightly sclerotized and are supplied with an abundance of minute tactile spots (Brodsky, 1930). The eyespots are small black areas posterior to the bases of the antennae. There are usually nine tufts of small setae on the head capsule near the base of each antenna.

The labrum is a thick structure which projects anteriorly. On its ventral surface it bears two densely setaceous ridges which are widely separated distally and converging near the base of the labrum. The epipharynx is a median lobe situated just posterior to the point of convergence of the setaceous ridges. Pulikovsky (1924) has probably misidentified the epipharynx from serial sections, calling it the hypopharynx.

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[1] Contribution No. 10, Limnology Laboratory, Department of Biology, University of Colorado.

[2] University of Colorado, Boulder, Colorado.

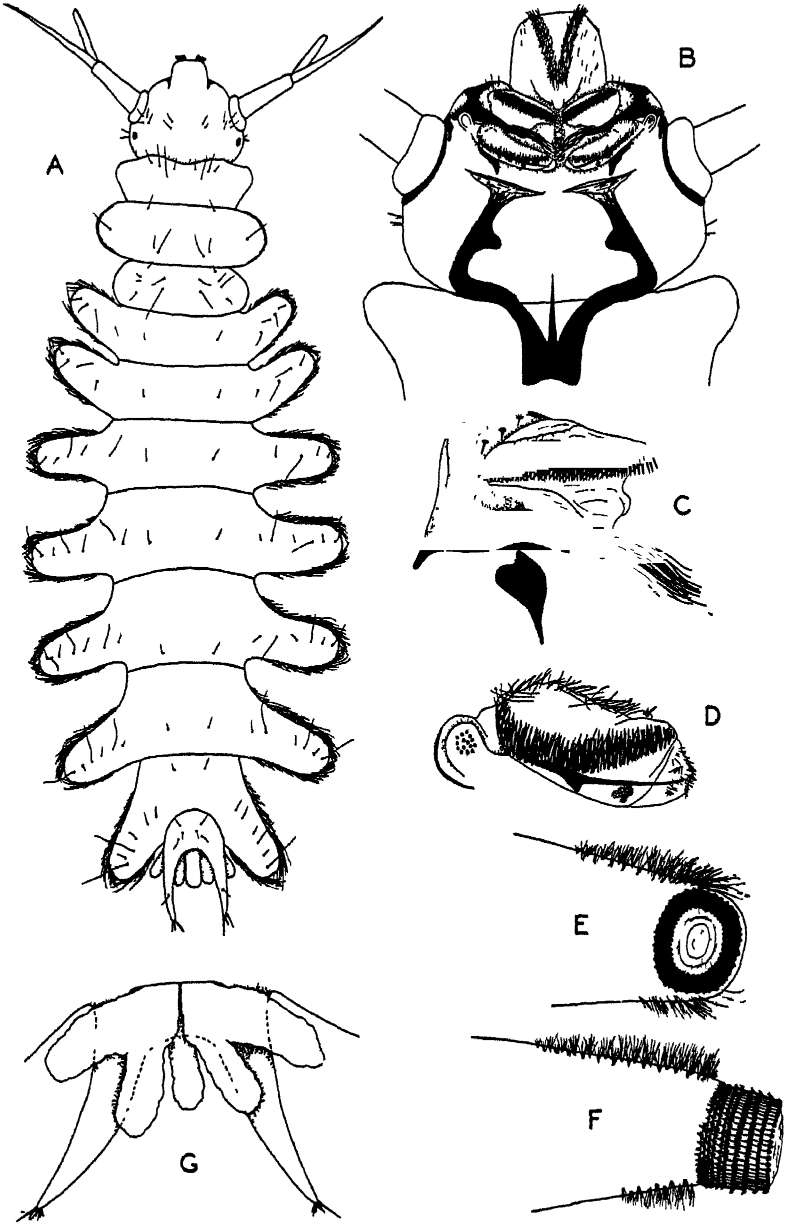

Fig. 1. Anatomical details of the mature larva of *Deuterophlebia coloradensis*, new species. A, dorsal view (fine pubescence omitted), × 28; B, ventral view of head; C, ventral view of right mandible; D, ventral view of right maxilla; E, ventral view of proleg in normal position, curved toward observer; F, ventral view of proleg which has been straightened out to show relationships of rings of hooks; G, ventral view of posterior end.

The mandibles are of a peculiar construction (fig. 1C). The basal portion consists of a rigid, heavily sclerotized ring which is very narrow ventrally and broad dorsally. At the median posterior margin of this ring is a tuft of long bristles directed toward the mouth opening. There are three short setae on the anterior part of the ring. The remainder of the mandible consists of a soft portion capable of being extended or folded back into the sclerotized ring. Near the anterior margin it bears two comb-like rows of heavy teeth, one superimposed upon the other. The teeth of the ventral comb point backward, but those of the dorsal comb point obliquely outward. A flat, heavily sclerotized piece is attached to the cuticle at the base of the mandible; Pulikovsky believes that it serves for the attachment of muscles.

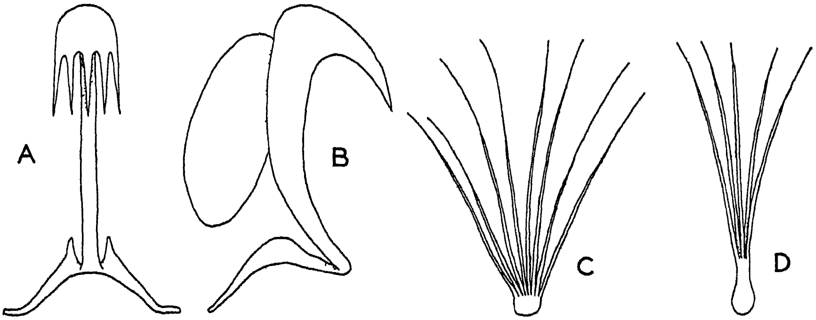

Fig. 2. Cuticular structures of the larva of *Deuterophlebia coloradensis*, new species. A, fronta view of claw of proleg; B, lateral view of claw of proleg; C and D, typical branched hairs from proleg.

The maxillae are highly developed but simple in form (fig. 1D). The maxillary lobe is a large, soft, transverse structure supported by a thin sclerotized rod. On the face of the lobe there is a dense comb-like device consisting of several irregular rows of heavy teeth, and along the front margin there is an irregular row of setae. At the median margin there are several short rows of fine setae, and near the posterior margin is a small irregular area which appears to consist of many minute granules. The palp is lateral to the maxillary lobe and is situated on a strongly sclerotized prominence. It is small, flat, and rounded and bears a cluster of chitinous buds.

The labium is absent, but, as pointed out by Pulikovsky, the maxillae oppose each other in such a fashion as to close effectively the buccal cavity and function as a labium.

The mandibular combs are said to be used for scraping diatoms and other algae from rock surfaces, while the mandibular bristles and maxillary combs strain this food from the water and guide it into the mouth.

THORAX: The thoracic segments are flat and distinctly separated from each other. The mesothorax is the widest and longest of the three, and the metathorax is narrowest and shortest. The prothorax slightly overlaps the posterior margin of the head. The prothorax, mesothorax, and metathorax have about eight, eight, and 12 setae, respectively, on the dorsal surface.

ABDOMEN: The abdomen consists of eight segments, increasing in size in the middle so that the fourth segment is slightly larger than either the third or fifth. Each of the first seven segments bears a pair of large prolegs. These prolegs originate laterally on the segments, but are curved downward distally so that the flattened pad-like tips come in contact with the substrate. The third, fourth, and fifth pairs of prolegs extend at almost right angles from the long axis of the body, but the first and second extend obliquely forward, and the sixth and seventh obliquely backward. At the end of each proleg, and surrounding the flattened tip, is a series of rings of peculiar, minute, sclerotized claws (figs. 1E, F, 2A, B). Each claw is roughly Z-shaped and consists of a curved, ctenoid portion with five teeth and a long, flat, keeled stalk or pedicel, the basal portion of which is bifurcated (fig. 2A, B). The claws of the more distal rings are the longest. The number of rings of claws on the first proleg is nine for all 12 larvae examined, but the number varies inconsistently from eight to 12 on the other prolegs, although there are usually nine to 11. Much of this variation is probably due to the fact that many of the claws or incomplete rings of claws are lost or torn off during the normal activities of the larvae. Also, the rings of claws are sometimes obviously incompletely formed and may extend only a third of the way around the proleg. On a proleg of one paratype, for example, there are eight rings of claws on the outer surface and 11 on the inner. Along the anterior and posterior margins of each proleg there are three to five rows of branched, brush-like hairs (fig. 2C, D). The length of the hairs increases gradually from the basal to the distal portion of the prolegs.

The prolegs are specialized for clinging to the rocks of stream beds in swift currents, the chitinous pad at the tip of each proleg together with the surrounding rings of claws acting like a somewhat imperfect sucking disc. The action and detailed anatomy of this apparatus have been explained by Pulikovsky. Unlike blepharocerid larvae, *Deuterophlebia* does not cling tightly to the substrate and can be easily removed with forceps or fingers.

The last abdominal segment (fig. 1G) is comparatively small and is provided with two long, tapering, sclerotized processes, each of which bears three or four flat terminal setae. On the ventral side of this segment and partially hidden by it are five blunt, cylindrical, delicate lobes or sacs arranged around the anal opening. One lobe is median and slightly dorsal, and the other four are paired, lateral, and more ventral. They have a very thin cuticle, large hypodermal cells, and are devoid of tracheation. As emphasized by Pulikovsky, it is likely that these lobes may function as blood gills. The fact that the tips of the Malpighian tubules project out into four of these lobes, however, may indicate that they have some osmoregulatory or excretory function.

In addition to the fine, dense pubescence on the dorsal surface, each abdominal segment and its two prolegs bear a total of about 12 setae. The ventral surface of the abdomen is naked.

LARVAL DEVELOPMENT: Both Kitakami (1938) and Brodsky (1930) have shown quite conclusively that Japanese and continental Asiatic species of *Deuterophlebia* have four larval instars. These stages may be distinguished on the basis of three different morphological features: the length ratio of the segments of the antennae, the number of rings of claws on the prolegs, and the total body length. All 12 specimens of *Deuterophlebia coloradensis*, however, seem to belong to a single, last instar. There are no significant differences in the number of rings of claws, the ratio of the length of the antennal segments is the same, and all larvae are in the same general size group. Four paratype specimens were approaching pupation when collected, and the developing pupal respiratory filaments can be easily seen through the integument in the lateral portions of the prothorax. The three smallest specimens, ranging from 3 to 3.3 mm. in length, have a more transparent integument than the others, but it is likely that they had passed through an ecdysis only a short time before being collected. Kitakami has shown that such larvae are usually relatively small.

TYPE MATERIAL: Holotype mature larva from Boulder Creek, Boulder County, Colorado, July 31, 1944, elevation 1810 meters; in the American Museum of Natural History. Paratypes are in the author's collection.

PUPA

GENERAL CHARACTERISTICS: Six complete pupae and six empty pupal cases were collected. Superficially the pupae resemble blepharocerids and are adapted to a life on rocks in swift streams. They are broadly oval, only slightly convex

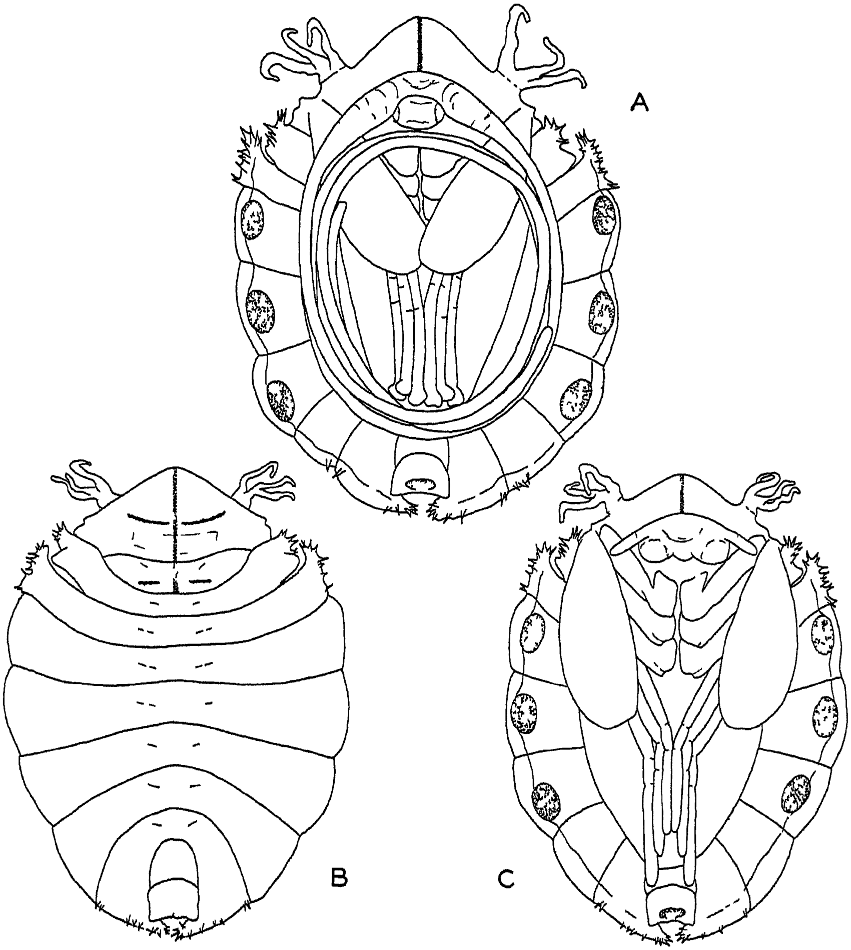

Fig. 3. Anatomical features of the pupae of *Deuterophlebia coloradensis*, new species. × 29. A, ventral view of male pupa; B, dorsal view of female pupa; C, ventral view of female pupa.

dorsally, and flat ventrally. The dorsal surface is strongly sclerotized and dark brown or blackish in color, chiefly due to an abundance of dark, round to oval granulations on the cuticle. These granulations range from 3.5 to 6.5 microns in diameter. The ventral surface is covered with a thin, colorless cuticle, especially in the younger pupae.

Sexual dimorphism is obvious. The female has short antennal sheaths which scarcely reach to the base of the wing sheaths, but the male has enormously long antennal sheaths, each of which is coiled in about two and three-quarters large, elliptical rings on the ventral surface (fig. 3A). One pupa and one pupal case are males; the other 10 specimens are females.

There is a wide range in total body length, the extremes being 2.1 and 2.9 mm., and the average being 2.3 mm. Brodsky and Kitakami have noted comparable variations in other species.

Head: The head lies on the ventral side of the body and is completely hidden by the thorax. The head of the male is much larger than that of the female.

THORAX: The prothorax is entirely fused with the mesothorax, and the latter is roughly triangular in shape with a very broad base. On the anterior lateral margins of the mesothorax are two respiratory processes. Each consists of a short broad base and three slender, elongate, irregularly bent filaments. Somewhat similar structures occur in some Chironomidae and Simuliidae. The metathorax does not reach the lateral margins of the body but is completely enclosed between the mesothorax and first abdominal segment. Extending throughout the length of the thorax is a longitudinal seam consisting of closely arranged granules. At the end of the pupal stage this seam splits open and permits the emergence of the imago. In the middle of the mesothorax is a pair of thin, transverse, heavily sclerotized bands, one on each side of the midline. Two similar but shorter bands occur on the metathorax.

Ventrally the sheaths containing the thoracic appendages may be seen. The oval-oblong wing sheaths extend as far as the fourth abdominal segment. The femoral portions of the leg sheaths extend anteriorly and laterally, but the succeeding portions are directed posteriorly near the midline. The tips of the leg sheaths in the male are swollen, due to the large empodia of the imago.

ABDOMEN: The first and second abdominal segments are very narrow and project anteriorly at the lateral margins in the form of prominences bearing small, stout, thorn-like spines. The number of thorns is highly variable and has no relation to the size or sex of the pupa. In the 12 specimens available the number on each side of the first abdominal segment ranges from four to 10 with an average of seven, and on the second segment the number ranges from eight to 16 with an average of 11. The seventh segment projects inward on each side at its posterior margin and almost completely encloses the succeeding segments. Along the lateral margin of the abdomen near the suture between the sixth and seventh segments is a group of none to nine thorns with an average of four. Along the posterior margin of the seventh segment is a group of similar thorns ranging from three to 10 on each side with an average of seven. The eighth segment is small and enclosed by the seventh and ninth. The ninth segment is completely fused with the tenth and is roughly square in shape.

Near the lateral margins of the ventral surface of the third, fourth, and fifth abdominal segments are paired, oval, adhesive pads by which the pupa remains tightly attached to the substrate. These pads do not project from the general body surface and appear to be composed of small black granules and irregular patches. Presumably some adhesive substance is produced in these six areas. The extreme lateral portions of the abdominal segments are slightly more flattened than the rest of the body.

TYPE MATERIAL: Holotype female pupa from Boulder Creek, Boulder County, Colorado, July 31, 1944, elevation 1810 meters; in the American Museum of Natural History. Paratypes are in the author's collection.

ADULT

Thus far no adult specimens have been collected. Actually very few emerged Deuterophlebiidae imagoes have ever been found. Edwards (1922) collected two male *D. mirabilis*, Kitakami (1938) collected 57 female *D. nipponica* over a period of 12 years, and Yie (1933) found one female of the same species. All other records and descriptions of imagoes are from specimens which have been dissected from mature pupae. It is unfortunate that none of the pupae of *D. coloradensis* contain adults which can be removed and studied in detail. Kitakami believes that active imagoes are difficult to collect because they emerge during the night or very early morning and live for only a few hours.

The unusual nature of the imago has been emphasized by other writers. Among some of the more striking features are: the complete absence of mouthparts, the immense wings with elaborate secondary and concentric transverse folds, and the extremely long antennae in the male.

HABITAT AND DISTRIBUTION

Scattered larvae and pupae were collected from several northern Colorado mountain streams wherever diligent searching was carried out. These streams and the altitudes of collecting localities are as follows: Thompson River, 2750 meters; St. Vrain Creek, 1690 meters; North Boulder Creek, 2750 and 2190 meters: Boulder Creek, four localities between 1680 and 2100 meters. The early belief that *Deuterophlebia* is restricted to mountain streams at very high altitudes has now been largely discarded. Brodsky (1930) found *D. mirabilis* as low as 1000 meters in central Asia, and Kitakami (1938) reported *D. nipponica* from Japanese streams at altitudes of 150 to 1600 meters. Certainly the genus is not confined to cold waters, since some Colorado specimens were taken from streams having temperatures as high as 18.5° C. Other workers have collected larvae and pupae from waters having temperatures ranging from 4 to 18° C.

Deuterophlebia coloradensis is not restricted to torrents. Although some specimens were found on rocks near the base of a waterfall, others were collected from streams with a relatively smooth rubble bottom where the current was not over 2 meters per second. All specimens were on the upper surface of rocks and pebbles where they were exposed to the full force of the current.

No attempt was made to collect *D. coloradensis* before August 1; consequently no spring and early summer data are available concerning its abundance and occurrence. Nearly all of the larvae and pupae were collected in August, 1944, a few being found early in September. Intensive searching between September 15 and October 2 failed to reveal a single specimen. Kitakami collected *D. nipponica* larvae and pupae from March through November, but Brodsky collected immature stages of *D. mirabilis* between June and October in the more rigorous climate of the mountains of central Asia. The latter's contention that wintering-over occurs in the early larval instars seems to be a logical one, and presumably it applies to *D. coloradensis*. Yie (1933), on the other hand, believes that the larval period is very short in *D. nipponica* and is probably completed in two weeks. Both he and Kitakami contend that there are several generations per year.

The relative rarity of males has resulted in considerable speculation, and Kitakami has even suggested parthenogenetic development by the great majority of individuals.

COMPARATIVE NOTES ON THE SPECIES OF *DEUTEROPHLEBIA*

As shown in table 1, the genus *Deuterophlebia* consists of only four well-established species, the imagoes being known for only two of these. The paper of Pulikovsky (1924) requires some discussion with reference to this table. It appears that her specimens from Altai mountain streams consisted of at least two species, although she thought that she was dealing with a single species, which she designated as *Deuterophlebia* sp. Two distinct types of pupae are described in her paper, one with a long spine at the base of the thoracic respiratory filaments on each side of the mesothorax, and one without. The latter specimens were also examined by Brodsky (1930), and he appears convinced that they are identical with his own specimens of *D. mirabilis* Edwards. The specimens with the two thoracic spines, however, are unique and undoubtedly constitute a distinct species. This contention is shared with Brodsky and Kitakami. It is indicated as *Deuterophlebia* sp. in table 1. Pulikovsky dissected some female imagoes from the spined pupae, but her description of them is so general that it cannot be used for a comparison with imagoes of other species. The larvae described by Pulikovsky were also studied by Brodsky, and he is satisfied that they are *D. mirabilis.* Since larvae of different species are often

TABLE 1

SUMMARY OF THE GEOGRAPHICAL DISTRIBUTION, DESCRIPTIVE LITERATURE, AND PUBLISHED RECORDS OF THE SPECIES OF *Deuterophlebia*

Species	Known geographical distribution	Stage	Described and (or) recorded by
D. mirabilis Edwards	Mountainous areas of central Asia; roughly between 34° and 46° north latitude, and 69° and 99° east longitude	Larva	Pulikovsky (1924, as *Deuterophlebia* sp.); Brodsky and Brodsky (1926, as *Deuterophlebia* sp.); Brodsky (1930)
		Pupa	Pulikovsky (1924, as *Deuterophlebia* sp.); Brodsky and Brodsky (1926, as *Deuterophlebia* sp.); Brodsky (1930)
		Adult male	Edwards (1922); Brodsky (1930)
		Adult female	Brodsky (1930)
D. nipponica Kitakami	Widely distributed on the Japanese islands of Honshu and Kyushu	Larva	Kitakami (1929, as *Deuterophlebia* sp.); Kawamura (1932, as *Deuterophlebia* sp.); Yie (1933, as *Deuterophlebia* sp.); Kitakami (1938)
		Pupa	Kitakami (1929, as *Deuterophlebia* sp.); Kawamura (1932, as *Deuterophlebia* sp.); Yie (1933, as *Deuterophlebia* sp.); Kitakami (1938)
		Adult male	Kitakami (1938)
		Adult female	Kitakami (1929, as *Deuterophlebia* sp.); Kitakami (1938)
D. tyosenensis Kitakami	Northern Korea	Larva	Kitakami (1938)
		Pupa	Kitakami (1938)
D. coloradensis, new species	Northern Colorado	Larva	Pennak (present paper)
		Pupa	Pennak (present paper)
Deuterophlebia sp.	Yellowstone River and Lost Creek, Yellowstone National Park, Wyoming	Larva	Muttkowski (1927)
		Pupa (?)	Muttkowski (1927)
Deuterophlebia sp.	Convict Creek, Mono Co., Calif.	Larva	Pennak (present paper)
Deuterophlebia sp.	Rock Creek, Benton Co., Oregon	Larva	Pennak (present paper)
Deuterophlebia sp.	Altai Mountains	Larva (?)	Pulikovsky (1924)
		Pupa	Pulikovsky (1924)
		Adult female	Pulikovsky (1924)

similar in their more prominent characteristics, it is possible that some of the specimens were of the other species.

Muttkowski (1927) found a single larval specimen in the Yellowstone River, Wyoming. Since it was less than 1 mm. long, it was probably in the first instar. His description is very general, but it is not unlikely that it is *D. coloradensis*. Muttkowski also collected eight or nine specimens in the Yellowstone River and Lost Creek, Wyoming, which he thought *may* have been deuterophlebiid pupae; no description is given in his paper, however. Because of these uncertainties, Muttkowski's material is indicated in table 1 as *Deuterophlebia* sp.

During the organization of the present paper the author wrote to many institutions in the United States where large Diptera collections are kept, in an attempt to obtain additional, unpublished data. This correspondence netted only two new records. One was received from Dr. O. A. Johannsen, Cornell University, who stated that H. J. Reynor and R. S. Nielson collected some larvae in Convict Creek, Mono Country, California, in August, 1937, at an elevation of 7000 feet. The specimens "resembled Muttkowski's species." Their whereabouts is unknown.

The other new record involves a single larval specimen. It was collected in Rock Creek, Philomath, Oregon, in May, 1942, and through the kindness of Dr. H. A. Scullen of Oregon State College the writer was permitted to examine it. In its morphological features it is indistinguishable from mature *D. coloradensis* larvae. A more reliable identification, however, must be delayed until the pupa can be examined. In the meantime the larva is recorded as *Deuterophlebia* sp. in table 1.

In general, the mature larval stages of the four well-established species of *Deuterophlebia* are very similar and often cannot be distinguished from one another on the basis of gross structure. This is evident from table 2 where three important morphological features are compared. It is unfortunate that other papers do not contain accurate descriptions of anatomical details, especially mouthparts and setation, which might be useful and definitive criteria for separating species.

The pupal stage, on the other hand, is much more distinctive, and identifications may be easily made by means of certain features of the thoracic region, as indicated in the following key.

KEY TO THE PUPAE OF *Deuterophlebia*

1. With one or two long, narrow spines on the thorax near each group of respiratory filaments................2
   Without such spines.......... 3
2. With two long thoracic spines on each side; northern Korea.............. ....*D. tyosenensis* Kitakami
   With one long thoracic spine on each side; Altai Mountains........... ....*Deuterophlebia* sp.
3. With a pair of short, thin, transverse, heavily sclerotized bands near the midline of most of the abdominal segments; without granulations on the last two abdominal segments; Honshu and Kyushu, Japan....... ....*D. nipponica* Kitakami
   Without such abdominal bands; granulations present on the last two abdominal segments................4
4. With a pair of long, thin, transverse, heavily sclerotized bands on the mesothorax; northern Colorado.... ......*D. coloradensis*, new species
   Without such mesothoracic bands; mountainous areas of central Asia.. ....*D. mirabilis* Edwards

The known geographical distribution of *Deuterophlebia* is an interesting one. The genus is widely distributed throughout the mountainous areas of central Asia as far south as the Himalayas. It occurs in northern Korea, and on the islands of Honshu and Kyushu in Japan. In North America it is known from Wyoming, Colorado, California, and Oregon, and it is likely that a search would show that it occurs throughout the mountainous western states and perhaps Canada. From the

TABLE 2

MORPHOLOGICAL COMPARISON OF MATURE LARVAE OF THE FOUR ESTABLISHED SPECIES OF *Deuterophlebia*

Species	Ratio of basal segment:ventral branch:dorsal branch of antennae	Average number of rings of hooks on prolegs	Average length, mm.
D. mirabilis Edwards	1:1:1 25	13 to 14	4.0 to 5.0
D. nipponica Kitakami	1:1:2–3	9 to 12	2.8 to 4.3
D. tyosenensis Kitakami	1:0.9:1.8	9 to 11	3.6
D. coloradensis, new species	1:1:2	9 to 11	3.9

standpoint of ecological requirements, the immature stages of *Deuterophlebia* in these areas appear to be confined to rapid, clear streams having rocky bottoms and summer temperatures below 19° C. Theoretically, therefore, it could occur in such places as the northern Appalachian Mountains and the mountainous portions of Europe. It is particularly striking that the genus has never been reported from the Alps and associated areas, especially since the bottom fauna of alpine streams has been studied more intensively than that of any other group of mountain streams. It appears logical to infer that the genus does not occur in Europe. Aside from the aquatic stages, however, the geographical distribution of *Deuterophlebia* is probably largely determined by certain habits of the imago. The facts that they are never abundant, do not feed, and are feeble fliers, for example, would all tend to decrease markedly their rate of geographical spread.

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THE PSEUDOSCORPION GENUS *ALBIORIX* CHAMBERLIN[1]

BY C. CLAYTON HOFF[2]

In collections of pseudoscorpions from the American Museum of Natural History, the writer found representatives of four new species of the genus *Albiorix* Chamberlin. The present paper describes these new species and in addition gives a key for separating the known species of the genus.

All descriptions are based on specimens cleared in beechwood creosote and mounted in balsam, the body but not the appendages being treated with potassium hydroxide previous to clearing. The type specimens are deposited in the American Museum of Natural History.

SUBORDER DIPLOSPHYRONIDA CHAMBERLIN

IDEORONCIDAE CHAMBERLIN

Ideoroncinae Chamberlin

ALBIORIX CHAMBERLIN

The genus *Albiorix* was established by Chamberlin (1930), who designated as the type species *Ideoroncus mexicanus* Banks, 1898, a form which has been reported from San Miguel de Horcasitas, Sonora, Mexico (holotype), Las Animas Bay, Lower California, Mexico (neotype), San Marcos and San Esteban Islands in the Gulf of California, Mexico, and in the United States from El Centro, California, and a few localities in Utah. In addition the genus includes *Albiorix parvidentatus* Chamberlin, 1930, from Riverside County, California, and *A. edentatus* Chamberlin, 1930, from Mt. Hamilton, California. Locality records of the species of *Albiorix* described in the present paper extend the geographical range of the genus to the central and southern parts of Mexico.

KEY TO SPECIES OF THE GENUS *Albiorix*

1. Fixed chelal finger with about 30 teeth, vestigial ones included............2
   Fixed chelal finger with more than 45 teeth, vestigial ones included......4
2. Length about 2.4 mm.; all chelal teeth greatly reduced.................. ....*A. edentatus* Chamberlin
   Length no more than 2 mm.; at least some chelal teeth well defined.....3
3. Movable finger of chela with one or two clearly defined marginal teeth; palpal femur no more than 3.6 times as long as wide, tibia no more than 2.5 times as long as wide............. ......*A. veracruzensis*, new species
   Movable finger of chela with six to eight clearly defined teeth; femur 4 to 4.2 times as long as wide, tibia 3.1 times as long as wide............... ....*A. parvidentatus* Chamberlin
4. Movable finger of chela longer than 0.85 mm.; palpal femur 4.5 or more times as long as wide; tibia of fourth leg more than 4.5 times as long as wide.....................5
   Movable finger of chela shorter than 0.85 mm.; palpal femur about 4 times as long as wide; tibia of fourth leg less than 4.5 times as long as wide.........................6
5. Body less than 2.75 mm. long; 14 to 20 moderately well-developed teeth on margin of movable finger of chela.......*A. mexicanus* (Banks)
   Body longer than 3 mm.; all teeth of movable finger vestigial........... ....*A. magnus*, new species

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6. Teeth of fixed chelal finger conical, apex of each not directed toward the base of the finger; all except the distalmost tooth of movable finger vestigial; tibia of both first and fourth legs with length less than 4 times the depth; hand of chela in lateral view almost symmetrical, little swollen dorsally.........................
........*A. conodentatus,* new species

Teeth of fixed chelal finger retro-conical with the apex directed toward the base of the finger; several of the distal teeth of the movable finger fairly well developed but not acute; tibia of both first and fourth legs with length more than 4 times the depth; hand of chela in side view asymmetrical, swollen dorsally.............
.....*A. retrodentatus,* new species

Albiorix magnus, new species

Figures 1–5

MALE: Unknown.

FEMALE: Body and appendages relatively slender; delicate, not heavily sclerotic; light yellowish brown color; total length 3.3 mm. Dorsal face of carapace stippled, laterally and posteriorly with weak net-like sculpturing, not granular; posterior margin straight, lateral margins slightly convex, anterior margin with a median obtuse angle; tooth-like projection at the juncture of the anterior and each lateral margin; four prominent acuminate setae on or near the anterior margin between the eyes, four very weak setae along the posterior margin; face of carapace with a few extremely fine setae (care must be taken not to confuse areoles of broken setae with scattered discoidal microlyrifissures); one pair of eyes, each removed by about its diameter from the anterior margin of the carapace, diameter of cornea 0.055 mm.; carapace about 1.05 mm. long, greatest width 0.8 mm., posterior width slightly less, width just posterior to eyes 0.625 mm.

Abdomen little sclerotic, flimsy (treated specimen), length 2.3 mm., width 1.05 mm., length 2.2 times the width; tergites and sternites smooth and undivided except for weak, net-like markings on the anterior portion of each of the first three tergites; tergal setae extremely fine and acuminate, varying in number from four to probably eight; most tergites with weakly developed pair of median and a similar pair of lateral slit-like lyrifissures; sternites with setae possibly varying from 10 to 14; all sternal setae delicate, easily broken, and difficult to count with certainty; sternal lyrifissures very similar to those of the tergites. Stigmatic plates little sclerotic, a single seta associated with each plate. Pleural membranes smoothly plicate.

Chelicera: Elongated, length 0.415 mm., width of base 0.195 mm.; base with six setae, all very slender, long, acuminate; exterior condylar lyrifissure about twice as long as the exterior one; flagellum of four setae, each finely serrate along the anterior edge. Fixed finger without lamina exterior; serrula interior consisting of about 20 (difficult to make accurate count) ligulate plates, the distal two plates with conspicuously serrate margins; apical tooth long and slender; about seven or eight acute teeth of varying size arranged along less than the terminal one-half of the inner margin of the finger forming a continuous row with two or three small denticles on the basal portion of the inner margin of the apical tooth. Movable finger 0.255 mm. long, serrula interior distally free and composed of about 24 (position of serrula precludes making an accurate count) simple, ligulate teeth; galea simple, slender, length about 0.095 mm.; apical tooth long and evenly curved; inner margin of finger swollen in the distal fourth and bearing six or seven well-developed, acute teeth.

Palpus: Moderately slender, light yellowish brown color, setae acuminate, relatively sparse, very fine, variable in length; surface of proximal podomeres granular, in distal podomeres granules confined to flexor surface of tibia and to ventral and inner surfaces of hand. Maxilla stout, 0.56 mm. long, 0.29 mm. wide; two long apical and one long subapical setae, smaller setae sparsely scattered on face of maxilla; subrostral supports about 0.15 mm. long. Trochanter with a single sublateral protuberance, inner margin convex, width 0.225 mm., length twice the width. Femur without definite pedicle, little widened distally, inner surface evenly convex, outer surface evenly concave except near the ends, length 1.17 mm., width 0.26 mm., length 4.5 times the width. Tibia slender, pedunculate, pedicle longer than wide, outer margin flatly convex, inner margin convex distal to the pedicle, arthropodal membrane of joint attached to inner surface near the distal one-fourth of the tibia, length 0.92 mm., width 0.27 mm., length 3.4 times the width. Chela in dorsal view with flattened outer margin, inner margin greatly swollen; setae sparse, long, fine, and acute; four tactile setae on dorsal surface of hand much distal to the center of the hand; three long acuminate setae arranged in a row across the outer surface of the hand close to the base of the movable finger; chela length 1.97 mm., width 0.53 mm., length 3.75 times the width; depth of hand 0.515 mm., length of hand with pedicle 0.895 mm. In lateral view, dorsal margin of hand swollen and greatly convex, ventral margin weakly convex; fingers curved and fairly slender, both with venom duct, venedens, and lamina defensor; tactile setae of fingers very numerous. Fixed finger in lateral view curved dorsally, slender, outer margin concave, inner margin convex; nodus ramosus slightly less than one-third of finger length from tip; 54 retro-conical teeth, contiguous, dispersed along the entire inner margin; at level of nodus ramosus, the distances between apices of two consecutive teeth about 0.019 mm.; only the proximal two teeth approaching the vestigial condition. Movable finger 1.185 mm. long, gradually narrowing to the tip, inner margin concave, outer margin convex; nodus ramosus about one-third of finger length from tip; all marginal teeth vestigial, distal ones flatly cuneate, proximal ones becoming weaker and finally disappearing entirely in the basal one-third of the finger length; about 26 teeth discernible; distance between apices of consecutive teeth at level of nodus ramosus about 0.023 mm.

Legs: Slender, smooth, yellow color, setae acuminate; claws simple; subterminal setae toothed. First leg with trochanter 0.19 mm. deep, length 1.4 times the depth; pars basilis of femur gradually increasing in depth toward the distal end; length 0.545 mm., depth 0.135 mm., flexor margin straight, extensor margin weakly concave especially in the distal one-half, a few very fine setae scattered over surface; pars tibialis a little less than one-half as long as pars basilis, length 0.255 mm., depth 0.12 mm., setae as in pars basilis; tibia little deepened distally, flexor margin weakly convex, extensor margin weakly concave, setae heavier and more numerous on the flexor than on the extensor surface, length 0.435 mm., depth 0.08 mm.; metatarsus subcylindrical, slightly narrowed distally, extensor margin very slightly concave, length 0.225 mm., depth 0.07 mm., setae as in tibia; tarsus elongated, distally somewhat narrowed, margins almost straight, setae numerous and fairly heavy, length 0.355 mm., depth 0.055 mm., length 6.5 times the depth; subterminal setae trifid. Fourth leg with trochanter 0.355 mm. long, 0.2 mm. deep, both margins evenly convex, few very fine setae; pars basilis 0.385 mm. long, 0.315 mm. deep; pars tibialis 0.535 mm. long, 0.315 mm. deep; entire femur with convex extensor margin but convexity more marked toward the proximal end of the margin, flexor margin straight in proximal two-thirds of femur, suture between pars basilis and pars tibialis perpendicular to the longitudinal axis of the podomere, setae sparse, very fine and short; femur length 0.865 mm., depth 0.315 mm., length 2.75 times the depth; tibia widest near the distal fourth, extensor margin basally convex but very slightly concave in the distal half, distal three-fourths of extensor margin evenly convex, setae stouter and slightly more numerous than on femur; length of tibia 0.605 mm., depth 0.125 mm., length 4.85 times the depth; metatarsus shaped much as in the first leg but more elongate, length 0.34 mm., depth 0.09 mm., a long tactile seta on the extensor surface about one-fourth of the length of the metatarsus from the base of the podomere; tarsus subcylindrical, a long tactile seta about 0.042 mm. from the base, other setae like those of metatarsus but more numerous; length of tarsus 0.46 mm., depth

0.065 mm., length 7.1 times the depth, subterminal setae bifid.

Genital complex: Anterior operculum (second sternite) with 10 short setae arranged in an irregular double row; third sternite unmodified and with six widely separated setae.

TYPE LOCALITY: A single specimen, the female holotype, in a collection taken 20 miles east of San Pedro, Mexico, by A. M. and L. I. Davis on July 5, 1936.

Albiorix magnus seems to be more closely related to *A. mexicanus* than to any other *Albiorix* species. Separation of the two species may be made readily by characteristics given in the key.

Albiorix veracruzensis, new species

Figures 6–9

MALE: Body moderately stout, appendages somewhat slender except femur of third and fourth legs; setae simple, acuminate; yellowish brown color, palps darker brown than body and legs; length 1.65–1.75 mm. Carapace not granular, dorsal surface stippled and bearing a few scattered acuminate setae, sides of carapace with net-like markings; posterior margin virtually straight, with four or six marginal setae; lateral margins weakly convex; anterior margin with a median obtuse angle, four marginal setae; a slight prominence at juncture of lateral and anterior margins; one pair of well-developed eyes, diameter of cornea 0.05 mm., eye removed from the anterio-lateral corner of the carapace by about two-thirds of the diameter of the eye; length of carapace 0.51–0.55 mm., greatest width 0.445–0.48 mm., length 1.1 to 1.15 times the width; posterior width slightly less than greatest width; width just posterior to eyes 0.365–0.375 mm.

Abdomen subovate; tergites and sternites (except the fourth) undivided, not granular; fairly sclerotic, abdomen retaining shape well when treated with potassium hydroxide; all setae acuminate, fine, easily broken; length of abdomen about 1.2 mm., width 0.64–0.75 mm., length 1.6 to 1.8 times the width. Anterior three tergites partially sculptured with net-like lines; total number of setae for tergites 1 through 10 as follows: 2:2–4:6–8:10–12:10–12:12–14:12–14:14–16:14–16:12–14; setae forming a single marginal row; each tergite with a submedial and a lateral pair of slit-like lyrifissures; also the central tergites with a few discoidal microlyrifissures. Sternite 4 divided by a median suture and with six setae; setae of more posterior sternites gradually increase in number with the maximum about 20; lyrifissures as on the tergites. Pleural membranes marked by longitudinal plications. Each weakly developed stigmatic plate with one seta.

Chelicera: Moderately stout, length 0.24–0.26 mm., width of base 0.135 mm.; base with six acuminate setae; a discoidal microlyrifissure on base may easily be mistaken for a setal areole from which the seta is broken; the slit-like exterior condylar lyrifissure about three times as long as the exterior lyrifissure; flagellum with four setae, unilateral serrations minute. Fixed finger with slender apical tooth; about eight small denticles arranged along the basal half of the apical tooth and extending to the inner margin of the finger, followed proximally by three (or four) well-developed, much larger, acute teeth on the inner margin; serrula interior with 16 ligulate plates (difficult to count accurately), margin of plates appearing entire. Movable finger 0.15–0.17 mm. long, basally stout; inner margin concave with five or six (the proximal one usually much reduced) acute teeth confined to the terminal third of the finger, galea simple, slender, acute, length 0.061 mm.; serrula exterior with 19 ligulate plates (in holotype, possibly also in paratypes); distal one-fourth or less of serrula free.

Palpus: Brownish color; smooth except for granulations on the protuberance of the trochanter, on the medial side of the femur, and to a very slight degree on the medial side of the tibia; setae acuminate, long, not abundant. Maxilla 0.23–0.25 mm. long, 0.155–0.175 mm. wide; subrostral support 0.085–0.095 mm. long. Trochanter with sublateral protuberance; 0.21–0.225 mm. long, 0.135–0.15 mm. wide. Femur subcylindrical, widest near the distal one-third, outer margin nearly straight in the central half but convex at both ends, inner margin straight to very slightly convex in proximal portion but convex distally, length 0.575–0.61 mm., width 0.165-0.175 mm., length 3.5 to 3.55 times the width. Tibia with short, stout pedicle; outer margin evenly convex, inner margin convex but in some individuals with a slight concavity basal to the midpoint; length 0.385–0.415 mm., width 0.16–0.17 mm., length 2.3 to 2.5 times the width. Chela in dorsal view with hand wide but fingers relatively narrow, outer margin moderately convex, inner margin swollen and more convex; in lateral view both ventral and dorsal margins appear convex; dorsal surface of hand with four tactile setae distal to the center, three tactile setae in a row on external surface near base of fixed finger; tactile setae of fingers numerous; length of chela 0.93–0.94 mm., width 0.26-0.28 mm., length 3.35 to 3.55 times the width; length of hand including pedicle 0.465–0.47 mm.; depth of hand slightly less than width, 0.25–0.26 mm.; movable finger 0.51–0.52 mm. long; both fingers with venom duct and venedens; lamina defensor vestigial in both fingers. In lateral view, fixed finger almost straight, both internal and external margins convex; 28 to 30 teeth, of which the first three are acute and conical, the fourth almost symmetrically acute but with base wider than in the first three, while the remainder are retro-conical and asymmetrical; a few of the proximal teeth much flattened but with the cusp not reduced; distance between cusps of consecutive teeth 0.017 mm. at level of nodus ramosus; nodus ramosus two-fifths or slightly more of finger length from tip. Movable finger with external margin convex, internal margin weakly concave; 21 to 23 teeth; the first well developed, conical, with a cusp; the second tooth cuneate, subvestigial, lacking the cusp; the remainder vestigial, greatly flattened, and without a cusp; length of base of vestigial tooth about 0.0225 mm. at level of nodus ramosus; nodus ramosus about two-fifths of finger length from the tip.

Legs: Yellow color; femur stout, other podomeres more slender; surface smooth; setae sparse on femora but abundant on more distal podomeres, acuminate, long on flexor surface of femora and tibiae but short and fine on the extensor surface of these podomeres; claws simple. First leg with trochanter stout, 0.14–0.145 mm. long, 0.115 mm. deep; pars basilis with flexor margin nearly straight, extensor margin weakly convex, deepest distally, length 0.27–0.295 mm., depth 0.091–0.1 mm.; pars tibialis with convex outer margin, inner margin weakly convex, length 0.155–0.165 mm., depth 0.084–0.091 mm.; tibia subcylindrical, length 0.185–0.195 mm., depth 0.065 mm., length 2.85 to 3 times the depth; metatarsus with extensor margin very weakly concave, flexor margin nearly straight, length 0.14–0.147 mm., depth 0.53 mm.; tarsus tapering distally, length 0.21–0.215 mm., depth 0.04–0.042 mm., length 5 to 5.25 times the depth; subterminal setae bifid. Fourth leg with trochanter 0.195–0.21 mm. long, 0.118–0.13 mm. deep; pars basilis 0.25–0.265 mm. long, 0.2–0.22 mm. deep; pars tibialis 0.25-0.275 mm. long, 0.19–0.21 mm. deep; entire femur 0.48–0.495 mm. long, 0.2–0.22 mm. deep, 2.25 to 2.4 times as long as deep, flexor margin with central portion virtually straight, extensor surface much swollen; tibia with extensor margin proximally convex but distally straight or slightly concave, flexor margin convex, length 0.32–0.33 mm., depth 0.0875–0.09 mm., length 3.6 to 3.7 times the depth; metatarsus distally narrowed, 0.19-0.205 mm. long, depth 0.066–0.068 mm.; tarsus widest near basal two-fifths, length 0.275–0.28 mm., depth 0.0455–0.0485 mm., length 5.8 to 6 times the depth; subterminal setae trifid; tactile setae broken in all specimens.

Genital complex: Anterior operculum with nine to 12 acuminate setae; posterior operculum with seven to nine setae.

Female: Unknown.

Tritonymph: An immature individual, probably a tritonymph; very similar in general appearance to the male; length 1.55 mm.; carapace 0.46 mm. long, 0.375 mm. wide; abdomen 1.05 mm. long, width approximately 0.65 mm.; tergites as in the adult except never more than 10 setae in one tergite; second and third sternites with two setae each, fourth with four setae, more posterior sternites apparently with 10 setae; lyrifissures of abdomen, the pleural membranes, and the stigmatic plates as in the adult.

Chelicera: Slightly smaller and somewhat stouter than in the adult; movable finger length 0.14 mm.; base with six setae; exterior lyrifissures and flagellum much as in the adult; dentation of fingers as in adult except that larger teeth are more variable in size; serrula interior with 13 plates; movable finger as in the adult except that the plates of the serrula exterior are reduced to about 18; galea 0.0585 mm. in length.

Palpus: Length: width ratio and shape of podomeres much as in the adult except that the flexor margin of the femur is more evenly convex so that the inner and outer margins are subparallel; femur length 0.495 mm., width 0.145 mm.; tibia 0.3 mm. long, 0.14 mm. wide; chela 0.81 mm. long, 0.225 mm. wide; movable finger length 0.44 mm. Only two tactile setae on exterior of hand near base of fixed finger and three tactile setae in group on dorsal surface. Twenty-three teeth on margin of fixed finger, arrangement and appearance as in the male except cusps are weakly sclerotic; movable finger with distal two teeth as in the male, others vestigial, teeth of entire row not in a favorable position for counting but apparently fewer in number than in the adult.

Legs: Much as in the adult except podomeres are shorter and stouter. First leg with pars basilis, 0.23 mm. long, 0.08 mm. deep; pars tibialis 0.125 mm. long, 0.075 mm. deep; tibia 0.155 mm. long, 0.059 mm. deep; metatarsus 0.11 mm. long, 0.0495 mm. deep; tarsus 0.185 mm. long, 0.042 mm. deep. Fourth leg in general as in the male; podomeres shorter and except for femur stouter than in the adult; trochanter 0.175 mm. long, 0.11 mm. deep; femur 0.4 mm. long, 0.145 mm. deep, length 2.75 times the depth; tibia 0.255 mm. long, 0.076 mm. deep; metatarsus 0.16 mm. long, 0.057 mm. deep; tarsus 0.22 mm. long, 0.045 mm. deep.

TYPE LOCALITY: Male holotype, two male paratypes, and one immature paratype from two collections made at La Buena Ventura, Veracruz, in July, 1909, by Dr. A. Petrunkevitch.

Albiorix veracruzensis is apparently related to *A. parvidentatus* by the small number of teeth on the chelal fingers and the body size. Separation is easily made on the basis of characteristics given in the key.

Albiorix retrodentatus, new species

Figures 10–16

MALE: Color of body and appendages yellow to yellowish brown; body and legs slender, palpi moderately so; all setae acuminate; length 2.2–2.4 mm. Carapace not granular, dorsal surface stippled in appearance, posterior and lateral areas sculptured by weak lines forming a network pattern; posterior margin weakly convex, lateral margin convex especially in the anterior one-third; anterior margin with a median obtuse angle; juncture of anterior and lateral margins forming a blunt and weak projection; widest in the anterior half; length 0.7–0.72 mm., greatest width 0.54–0.56 mm., posterior width slightly less; width just behind eyes 0.415–0.43 mm.; diameter of eye 0.04–0.045 mm.; distance from eye to anterior margin of carapace much less than the diameter of the eye; six slit-like lyrifissures on dorsal face of carapace; setae very fine, easily broken; anterior margin with a pair of submedial setae and another pair somewhat removed from the anterior margin near the eyes; six or eight extremely fine setae near the posterior margin; other setae scattered sparsely over the face of the carapace.

Abdomen 1.5–1.7 mm. long, width about 0.7–0.75 mm.; tergites and sternites not divided; anterior portion of first four sternites marked with net-like lines; most tergites with a median and a lateral pair of slit-like lyrifissures; total number of setae for each tergite fewer than 10 in number, exact count difficult as the areoles of broken setae are easily confused with the discoidal microlyrifissures; sternite four with about six setae, maximum number in any sternite apparently 10 or 12, numerous discoidal microlyrifissures within setal row. Pleural membranes longitudinally plicate; each stigmatic plate with one acuminate seta.

Chelicera: Fairly stout, length 0.275–0.29 mm., width of base 0.15 mm.; base with six setae, all acuminate; flagellum composed of four setae, weak unilateral serrations probably present on all flagellar setae; outer surface of base with very weak scale-like markings; exterior condylar lyrifissure about three times as long as the exterior; a single discoidal microlyrifissure usually present on external surface of base. Fixed finger with apical tooth long and slender; six to eight minute denticles on the inner margin of the basal two-thirds of the apical tooth, followed proximally on the inner margin of the finger by two or three acute teeth, followed in turn by one to three greatly reduced or vestigial teeth; serrula interior of 16 or 17 ligulate plates, the margins of the distal two serrate. Movable finger 0.185–0.19 mm. long; inner margin of finger with three to five teeth of which the proximal one is usually smaller than the remainder, no more than one of the teeth proximal to the level of the galeal seta; galea simple, terminally curved, about 0.058 mm. long; serrula exterior free distal to the level of the galeal seta, with 21 or 22 ligulate plates (difficult to count accurately).

Palpus: Maxilla stout, 0.35-0.37 mm. long, 0.185–0.22 mm. wide, length 1.7 to 1.9 times the width; surface non-granulate, weak net-like markings chiefly on lateral surface, a few scattered acuminate setae, two apical setae and one long subapical seta; subrostral support 0.027 mm. long. Trochanter with granular sublateral protuberance, a few acuminate setae on the extensor surface, length 0.305 0.32 mm., length 2.1 times the width. Femur with granular surface and in addition scale-like sculpturing; a few very fine and acuminate setae present; inner margin convex, outer margin concave; length 0.69–0.74 mm., width 0.175–0.19 mm., length 3.9 to 3.95 times the width. Tibia elongated, pedicle longer than wide; outer margin with a weak concavity slightly proximal to the midpoint, inner margin with portion immediately distal to pedicle flattened, inner surface granular; a few short and fine setae especially on the extensor surface; length 0.59–0.625 mm., width 0.2–0.21 mm., length 2.95 times the width. Chela with fairly stout hand and slender fingers, hand with very few short setae, surface except on inner surface of hand smooth; usual group of four tactile setae on dorsum of hand distal to the center and a row of three tactile setae on external surface near base of movable finger; external margin weakly convex; internal margin bulging; in side view, hand with dorsal margin swollen and convex especially near base, ventral margin weakly convex; length of chela 1.295 mm. in holotype, 1.215 mm. in paratype, width, respectively, 0.375 mm. and 0.341 mm., depth of hand of each 0.32 mm., length of hand with pedicle 0.6 mm. and 0.59 mm., respectively; length of chela 3.5 times the width; length of movable finger of holotype 0.77 mm., of paratype 0.745 mm.; both fingers with numerous tactile setae, venom duct, venedens, and poorly developed lamina defensor; no accessory teeth. Fixed finger slender in lateral view, outer margin of finger little convex, inner margin more convex and with a row of well-developed marginal teeth, about 55 in holotype and 48 in paratype, all retro-conical and with conspicuous cusps except for loss of cusps and reduction in height of the proximal five or six teeth; at level of nodus ramosus, the distance between apices of consecutive teeth equals 0.012–0.0125 mm.; nodus ramosus between one-third and two-fifths of finger length from tip. Movable finger more slender than fixed finger; outer margin convex, inner margin concave; about 40 marginal teeth, all vestigial or subvestigial, anterior six or seven more elevated and rounded than the proximal teeth which are represented only by a slightly raised area marking the posterior portion of the tooth; length of tooth base at level of nodus ramosus about 0.014 mm.; nodus ramosus about one-third of finger length from tip.

Legs: Slender except femora of third and fourth legs; setae acuminate, sparse in proximal podomeres but abundant in distal podomeres; surface non-granulate;

claws simple; subterminal setae toothed. First leg with trochanter subtriangular, 0.18 mm. long, length 1.35 times the depth; pars basilis distally widened, length 0.34–0.345 mm., depth 0.099–0.1025 mm., length 3.4 to 3.45 times the depth, few setae; pars tibialis subrectangular, 0.18–0.185 mm. long, 0.0875–0.09 mm. deep; tibia with flexor margin weakly convex, extensor margin slightly concave, subcylindrical, length 0.285 mm., depth 0.063 mm.; metatarsus somewhat narrowed distally, length 0.16–0.165 mm., depth 0.05 mm.; tarsus slender, 0.24–0.25 mm. long, 0.038 mm. deep; distal three podomeres with abundant setae; subterminal setae trifid. Fourth leg with trochanter stout, length about 0.24 mm., length one and one-third times the depth; femur very stout, few setae, flexor margin almost straight in the center one-half but convex near the ends, extensor margin greatly swollen; pars basilis about 0.28 mm. long, length but little more than depth; pars tibialis 0.355–0.37 mm. long, 0.25–0.275 mm. deep, length 1.35 to 1.45 times the depth; entire femur 0.61–0.63 mm. long, depth 0.26–0.28 mm., length 2.25 to 2.35 times the depth; tibia with distal half much deepened, flexor margin weakly S-shaped, extensor margin distally straight but proximally convex, length 0.43–0.45 mm., depth 0.1025–0.107 mm., length 4.2 times the depth; metatarsus with flexor margin straight, extensor margin slightly concave, long sensory seta on extensor margin about 0.04 mm. from base, length 0.215 mm., depth 0.0725–0.0765 mm.; tarsus with flexor margin straight, extensor margin weakly convex, 0.32–0.33 mm. long, 0.0475–0.051 mm. deep, length 6.5 to 6.7 times the depth; setae very abundant on metatarsus and tarsus; subterminal setae bifid.

Genital complex: Anterior operculum with eight or nine acuminate setae; posterior operculum with 12 acuminate setae; two slit-like lyrifissures on each operculum; both opercula as well as anterior margin of fourth sternite very weakly sculptured by net-like markings.

FEMALE: Unknown.

TYPE LOCALITY: The male holotype and one male paratype found in a collection made by L. I. Davis from Mexcala, Guerrero, Mexico, on July 2, 1941.

Albiorix retrodentatus is very similar to *A. conodentatus*, the two being separated by characteristics indicated in the key.

Albiorix conodentatus, new species

Figures 17–20

MALE: Light yellowish brown; body slender; length 2.3 mm. Carapace nongranulate, dorsal face very faintly and finely stippled, rest of carapace marked by net-like lines; posterior margin straight with possibly four very fine setae; lateral margins weakly convex, each meeting the anterior margin in a weak protuberance; anterior margin forming medially an obtuse angle; anterior margin with a pair of submedial marginal setae and a pair removed somewhat from the anterior margin just medial to the eye; eye about 0.045 mm. in diameter, removed from the anterior margin of carapace by about one-half the diameter of the eye; a few fine setae scattered on face of carapace; length 0.67 mm., greatest width 0.51 mm., length one and one-third times the width, posterior width slightly less than the greatest width, width just behind eyes 0.39 mm. Abdomen somewhat elongate, length 1.6 mm., width less than one-half the length; tergites and sternites not divided; at least a part of each of the first four tergites marked with a net-like pattern formed of transverse anastomosing lines, tergite 1 with four fine setae, tergite 2 with six setae, maximum number of tergal setae apparently eight in posterior tergites; fourth sternite with four setae, gradually increasing to 10 or 12 in the central and posterior sternites; most tergites and sternites with a median and a lateral pair of slit-like lyrifissures and in addition a few discoidal microlyrifissures which are readily confused with areoles whose setae are broken. Pleural membranes longitudinally plicate; stigmatic plates each with one acuminate seta.

Chelicera: Length 0.26 mm., width of base 0.15 mm.; base with six acuminate setae; flagellum of four setae, unilateral serrations very minute; exterior condylar lyrifissure about twice as long as the exterior lyrifissure. Fixed finger with moderately slender and acute apical tooth with three or four fine denticles on the interior margin, these being continuous with the five or six variably developed teeth of the inner margin of the finger; serrula interior made up of 17 or 18 ligulate plates of which at least the distal one has a serrate margin. Movable finger 0.175 mm. long, somewhat slender; three or four acute and well-developed teeth followed by one or two weak teeth on the inner margin; outer margin little convex; apical tooth slender; galea simple, gently curved, 0.057 mm. long; serrula exterior distally free, made up, as accurately as can be determined, of 21 ligulate plates.

Palpus: Very similar in dorsal view to the palpus of *A. retrodentatus* except that the tibia is slightly more stout and the femur is a trifle more slender; granular on the surface of trochanter, on the flexor surface of the femur and tibia, and to a slight degree on the inner part of the hand near the base of the fingers; setae acuminate but sparse. Maxilla with two apical and one subapical setae, very slightly granular on the ventral face, otherwise with net-like markings; few fine setae; length 0.34 mm., width 0.19 mm.; subrostral support about 0.1 mm. long. Trochanters broken in specimen, 0.145 mm. wide; sublateral protuberance poorly developed; surface granular; a few acuminate setae on the flexor surface. Femur decidedly curved, flexor margin evenly convex, extensor margin except near ends evenly concave; length 0.69 mm., width 0.17 mm., length 4.05 times the width; flexor surface granulate, extensor surface with weak scale-like markings; a few long scattered setae. Tibia with granulations and setae as in the femur; central portion of extensor margin flattened, almost straight, but convex toward both ends; flexor margin convex except for flattened area distal to pedicle; pedicle longer than wide; length of tibia 0.56 mm., width 0.2 mm., length 2.8 times the width. Chela in dorsal view with hand widened, inner surface swollen, very convex; slightly granular on inner surface near base of hand; fingers slender; group of four tactile setae on dorsum of hand distal to center and three setae on outer surface of hand near base of fixed finger; tactile setae of fingers numerous; from the side, hand almost symmetrical with pedicle near center; dorsal and ventral margins of hand in side view subequally convex, the dorsal little more so than the ventral; chela 1.12 mm. long, 0.34 mm. wide, length 3.3 times the width; length of hand with pedicle 0.56 mm.; depth of hand much less than width, 0.29 mm.; movable finger considerably longer than hand with pedicle, 0.64 mm.; fingers moderately slender in side view, both with venum duct, venedens, lamina defensor, and marginal but no accessory teeth. Fixed finger with about 57 contiguous, conical to slightly subconical teeth, cusps well developed; four or five teeth at proximal end progressively reduced to the vestigial condition; teeth extend virtually to base of finger; at level of nodus ramosus, distance between apices of consecutive teeth equals 0.0085 mm.; nodus ramosus about three-eighths of the finger length from the tip. Movable finger with 42 marginal teeth, of which the distal five or six are subvestigial, the remainder vestigial; at level of nodus ramosus, base of vestigial tooth measures 0.0125 mm.; nodus ramosus three-eighths of the finger length from the tip.

Legs: Moderately slender except for trochanter and femur of the third and fourth legs; surface non-granular; claws simple; subterminal setae toothed; setae acuminate, sparse except on distal three podomeres. First leg with subtriangular trochanter, 0.17 mm. long, length 1.3 times the depth; pars basilis deepest distally, flexor surface slightly concave, extensor surface flattened except at base, length 0.31 mm., depth 0.0915 mm.; pars tibialis with both margins convex, the extensor more so than the flexor; length of pars tibialis 0.18 mm., depth 0.09 mm.; tibia of almost uniform depth throughout, extensor surface weakly concave, flexor margin convex, length 0.24 mm., depth 0.065 mm.; metatarsus subcylindrical, 0.15 mm. long, 0.0515 mm. deep; tarsus slightly narrowed distally, extensor margin very weakly convex, flexor margin almost straight, length 0.23 mm., depth 0.04 mm., subterminal setae trifid; tibia and tarsus with numerous acuminate setae. Fourth leg with trochanter stout, length 0.21 mm., 1.35 times the depth, both extensor and flexor surfaces convex; pars basilis subtriangular, length 0.265 mm., depth 0.235 mm.; pars tibialis 0.31 mm. long, 0.235 mm. deep; entire femur with extensor margin very convex, the basal part much more so than the distal; entire femur with central portion of flexor margin almost straight, suture between pars basilis and pars tibialis perpendicular to the longitudinal axis of the podomere, length of femur 0.555 mm., depth 0.235 mm.; tibia distally deepened, extensor surface convex basally but straight distally, flexor margin with proximal portion slightly concave but distal portion convex, length 0.37 mm., depth 0.097 mm.; metatarsus narrowed distally, flexor margin straight, extensor margin weakly concave, long tactile seta on extensor margin 0.035 mm. from base; length of metatarsus 0.205 mm., depth 0.0725 mm.; tarsus subcylindrical, 0.295 mm. long, 0.0455 mm. deep; setae numerous on last two podomeres; subterminal setae trifid.

Genital complex: Anterior operculum with nine acuminate setae; posterior with 12 acuminate setae, irregularly arranged in a transverse band; also four short setae on the posterior wall of the genital canal, two submedially on each side; each operculum with two slit-like lyrifissures.

FEMALE: Unknown.

TYPE LOCALITY: The single male holotype collected by Davis 5 miles west of Saltillo, Mexico, on July 5, 1936.

Albiorix conodentatus bears considerable superficial resemblance to *A. retrodentatus* but differs as indicated in the key.

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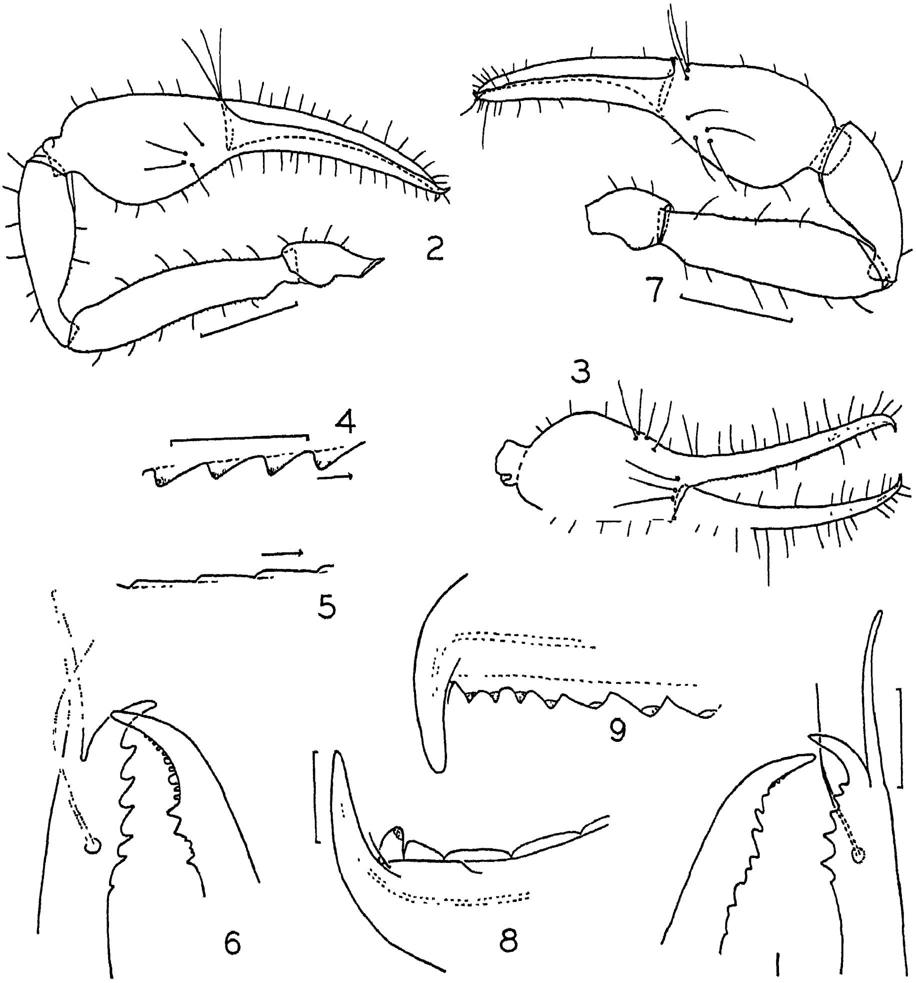


Albiorix magnus, new species

Fig. 1. Distal portion of cheliceral fingers, female holotype. Serrulae omitted. Scale equals 0.05 mm.

Fig. 2. Dorsal view of palp, female holotype. Scale equals 0.5 mm.

Fig. 3. Lateral view of chela, female holotype. Scale as in figure 2.

Fig. 4. Teeth of fixed finger of chela near level of nodus ramosus, female holotype. Arrow in this and subsequent drawings points distad. Scale equals 0.05 mm.

Fig. 5. Teeth of movable finger of chela near level of nodus ramosus, female holotype. Scale as in figure 4.

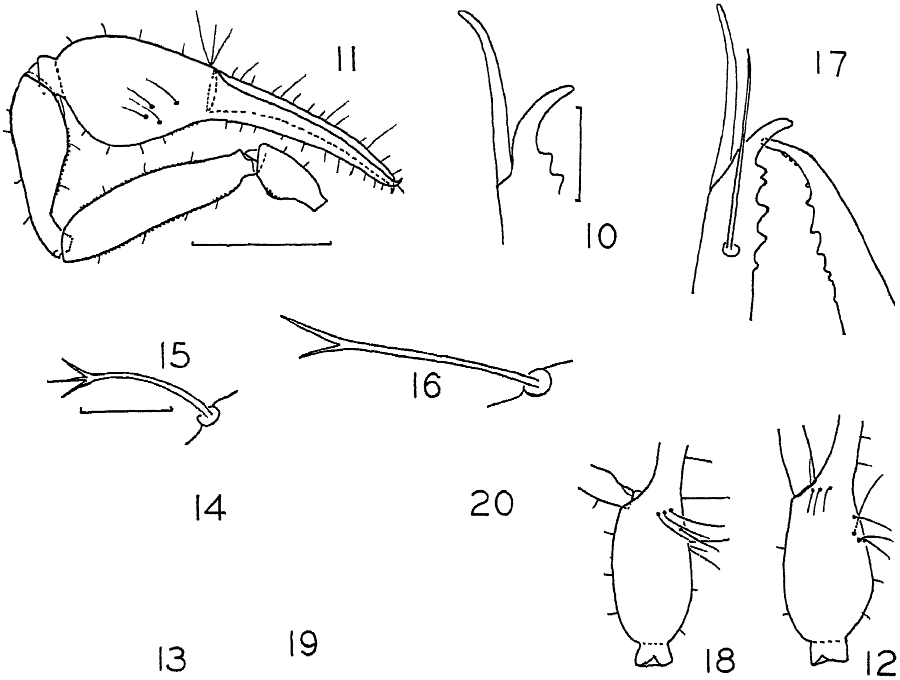
Albiorix veracruzensis, new species

Fig. 6. Distal portion of cheliceral fingers, male holotype. Serrulae omitted; structures indicated by dotted lines are supplied from a male paratype. Scale as in figure 4.

Fig. 7. Dorsal view of palp, male holotype. Scale equals 0.3 mm.

Fig. 8. Lateral view of tip of movable finger of chela, male holotype. Scale equals 0.02 mm.

Fig. 9. Lateral view of end of fixed chelal finger, male holotype. Scale as in figure 8.



Albiorix retrodentatus, new species

Fig. 10. Galea and terminal portion of movable finger of chelicera, male paratype. Scale equals 0.03 mm.

Fig. 11. Dorsal view of palp, male holotype. Scale equals 0.5 mm.

Fig. 12. Lateral view of hand, male paratype. Scale as in figure 11.

Fig. 13. Teeth of fixed chelal finger at level of nodus ramosus, male holotype. Arrow in this and subsequent drawings points distad. Scale as in figure 10.

Fig. 14. Teeth of movable finger of chela, male holotype. Scale as in figure 10.

Fig. 15. Subterminal seta of the first leg, male holotype. Scale equals 0.02 mm.

Fig. 16. Subterminal seta of the fourth leg, male holotype. Scale as in figure 15.

Albiorix conodentatus, new species

Fig. 17. Terminal portion of fingers of chelicera, male holotype. Serrulae omitted. Scale as in figure 10.

Fig. 18. Lateral view of hand, male holotype. Scale as in figure 11.

Fig. 19. Teeth of the margin of the fixed chelal finger at level of nodus ramosus, male holotype Scale as in figure 10.

Fig. 20. Teeth of the margin of the movable chelal finger at the level of the nodus ramosus, male holotype. Scale as in figure 10.

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A NEW CAECILIAN OF THE GENUS *GYMNOPIS* FROM BRAZIL

BY EMMETT REID DUNN[1]

Four caecilians from Brazil, recently sent me for identification by Mr. C. M. Bogert, represent an undescribed species of the genus *Gymnopis* and add that genus to the fauna of Brazil. It may be called

Gymnopis braziliensis, new species

TYPE: A.M.N.H. No. 51751, collected in 1943 by Mr. E. T. Gilliard.

TYPE AND ONLY LOCALITY: Manaos, Brazil.

DIAGNOSIS: A small *Gymnopis* (to 260 mm.), slim (length/diameter ratio about 70); eye invisible; tentacle remote from nostril and close to lip; 145 to 149 primaries; 23 to 27 secondaries; similar to *G. nicefori*, but with fewer secondaries.

DESCRIPTION: The material is more or less desiccated and flattened, but I compute the length/diameter ratio of the type (260 mm. long) to be 65, and that of A.M.N.H. No. 51752 (228 mm. long) to be 76. The color is dark gray, lighter below; head whitish. No inner mandibular teeth can be made out.

A.M.N.H. Nos.	PRIMARIES	SECONDARIES	COMPLETE SECONDARIES
51749	145	25	4
51750	146	27	6
51751	145	23	7
51752	149	25	6

REMARKS: Of the five South American species of *Gymnopis* now known, four have the eye usually invisible and the tentacle remote from the nostril and very close to eye when that can be seen. These are: *unicolor* Duméril, from the Guianas; *pricei* Dunn from the middle Magdalena; *nicefori* Barbour from the upper Magdalena and from the Cauca; and the present form.

They may be compared in a tabular form.

	PRIMARIES	SECONDARIES	LENGTH/ DIAMETER
French Guiana (eight)	108–120	55–74	27–39
British Guiana	100	44	40
Middle Magdalena	108	26	36
Upper Magdalena (five)	150–158	97–104	39–67
Cauca	138	95	41
Manaos (four)	145–149	23–27	65–76

Quite possibly more material might indicate the necessity of separating the British Guiana form and the Cauca form.

The fifth species, *G. albiceps* from the Oriente of Ecuador, has visible eyes, and the tentacle is about halfway between eye and nostril. It has 124 to 125 primaries, 45 to 55 secondaries, and a length/diameter ratio of 35–46.

The "South American" specimen, referred by me to *unicolor* in my 1942 paper (Bull. Mus. Comp. Zool., vol. 91, p. 472), with 109 primaries, 22 secondaries, and length/diameter of 34, appears to be a specimen of *pricei*. It is A.M.N.H. No. 1335, and, as it was presented by the Director of the Georgetown Museum, may actually have been taken in British Guiana. A recent recount indicates 25 secondaries.

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FOUR NEW *SCOTINOMYS* FROM COSTA RICA

BY GEORGE G. GOODWIN

In an effort to determine the geographical range of the little brown mice in Costa Rica I find it necessary to recognize two new species and two new subspecies. While large series of *Scotinomys* are now available from some localities, much of the intermediate territory and many regions are not represented, and the result of this study is not so conclusive as could be desired.

For the privilege of describing one of these species I wish to thank Mr. William P. Harris, Jr., whose generosity made available a valuable collection of Costa Rican mammals.

For the loan of material I am indebted to Dr. W. H. Burt, Museum of Zoology, University of Michigan, and to Miss Barbara Lawrence, Museum of Comparative Zoölogy, Cambridge.

Scotinomys teguina cacabatus, new subspecies

SAN CARLOS BROWN MOUSE

TYPE: A.M.N.H. No. 139733, adult female, teeth slightly worn, Lajas Villa Quesada, 5000 feet elevation,[1] 10 miles northwest of Volcan Poas, Province of Alajuela, Costa Rica; collector, C. F. Underwood, September 16, 1941. Besides the type there are nine topotypes and three specimens from Tapesco.

GENERAL CHARACTERS: Moderately large chestnut-colored *Scotinomys* of the *teguina* group with rather short close pelage, small ears, and relatively long tail; similar in general appearance and color to typical *teguina* from Coban, Guatemala, but larger in size, tail longer, and differing in some cranial characters.

DESCRIPTION: Color of type in unworn pelage is about Mars Brown, shaded with black, grading to Prout's Brown on head and sides of body; the fur Dark Neutral Gray from base for most of its length, tipped with reddish Cinnamon-Brown and mixed with long black hairs; inside of ears sparsely covered with short Cinnamon-Brown hairs, outside of ears Blackish Brown; fore and hind feet and upperside of tail Blackish Brown, the epidermis on underside of tail dusky but the hairs are buffy; underparts of body thinly washed with Cinnamon-Buff. Skull large, with a slender, sharply tapered rostrum; nasals long, slender, emarginate, and conterminous with premaxillae posteriorly; braincase broad and relatively low; interparietal long anteroposteriorly and narrow transversely, the anterior border not extending clear across the posterior border of parietals; supraorbital ridges forming a small though distinct shelf over orbits and extending in a low ridge across parietals. Interorbital region depressed at posterior border of nasals, anterior palatine foramina long and narrow, reaching posteriorly to anterior border of first molars, palate reaching to posterior border of last molars; zygomatic arches slender; molariform teeth small but not peculiar; masseteric process of the zygomatic plate strongly developed, extending the palate well forward in front of the first molar.

MEASUREMENTS OF TYPE: The measurements of an adult female topotype are in parentheses. Total length, 145 mm. (145); tail vertebrae, 60 (56); hind foot, 19 (19); ear, 13 (13). Skull: greatest length, 23.75 (23.1); condylobasal length, 22 (21.2); palatal length, 11.1 (11); length of nasals, 9 (8.6); interorbital width, 4.3 (4.3); zygomatic width, 11.6 (12+); width of braincase, 10.5 (10.7); width of palate across m^2–m^2, 5.4 (5.3); alveolar length of upper molar series, 3.8 (4).

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[1] Harris gives the elevation of Villa Quesada as 2200 feet. Underwood's collection came from the rocky ravines above the city.

Scotinomys t. cacabatus is readily distinguished from *S. t. irazu* by its larger size and noticeably darker and redder pelage, both above and below. The skull of *cacabatus* is also larger than that of *irazu*, with a broader, flatter braincase and a longer and more slender rostrum. It is more closely related to typical *teguina* but differs from the latter in its larger size, longer tail, somewhat richer shade in the color element, and larger skull with a longer and more sharply tapered rostrum. In typical *teguina* the interparietal extends in a narrow strip across posterior border of parietals, whereas in *cacabatus* it is triangular. *S. t. apricus* from Boquete is paler in color than *cacabatus*, and the skull and teeth are generally stronger with a heavier rostrum.

Some individuals in worn pelage are noticeably redder than the type, and the color of underparts is correspondingly darker and redder.

Scotinomys teguina escazuensis, new subspecies

ESCAZU BROWN MOUSE

TYPE: A.M.N.H. No. 138051; adult female, teeth worn; Los Higuerones, a cascerio or community of small farms, 5000 feet elevation, in the humid tropical highlands above the town of Escazu, Costa Rica; collector, C. F. Underwood, November 1, 1940. Besides the type there are 68 topotypes, five from the town of Escazu; La Carpintera, four; El Copey de Dota, four; Estrella de Cartago, five; El Muñeco, one.

GENERAL CHARACTERS: A small, auburn *Scotinomys* of the *teguina* group; considerably smaller than *cacabatus* and with color element less intense; averaging smaller than *irazu*, with shorter and closer pelage and color shade cinnamon or reddish instead of buffy.

DESCRIPTION: General color of type in worn pelage: upperparts between Prout's Brown and Auburn, shaded with black. Tail dusky but, below, the hairs are buffy white for most of its length; fore and hind feet Blackish Brown; underparts thinly washed with Cinnamon-Buff. Specimens in unworn pelage are heavily overlaid with black over rump and middorsal region. Skull small, with a small, smoothly rounded braincase and relatively short rostrum. Supraorbital shelves moderately developed and extending in a low ridge across parietals; masseteric process of zygomatic plate strongly developed.

MEASUREMENTS OF TYPE: The range of 16 topotypes is given in parentheses. Total length, 129 mm.; tail, in dry skin, 46; hind foot, 16, in dry skin, including claws, 17; ear, 12. Skull: greatest length, 21.6 (21.4–22.3); condylobasal length, 19.8; palatal length, 10.3; length of nasals, 7.3; interorbital width, 4; zygomatic width, 11.3; width of braincase, 10; width of palate across m^2–m^2, 5; alveolar length of upper molar series, 3.75 (3.6–3.9).

Scotinomys t. escazuensis may be readily distinguished from *cacabatus* by its smaller size and less intense shade of red in the color element. The differences between *escazuensis* and *irazu* are not quite so apparent. Large individuals may equal *irazu* in actual measurements, but the longer and more buffy-colored pelage of *irazu* is at once apparent when actual specimens of both races are compared. *Scotinomys t. irazu* is really larger than is implied in Allen's description. The type is an exceptionally small individual, the choice of the only two specimens with complete skulls in the type series. The hind foot measurement of the type, 17 mm., was apparently taken without claws, as the entire foot in the dry skin is 18 mm. M. A. Carriker did not specify the elevation of the type locality, but 11 specimens, collected by Underwood in the cool dry region at an elevation of 9400 feet on Volcan Irazu, are typical. Two specimens from Cartago, 4800 feet, taken at the base of the Volcan Irazu, are considered by the author as referable to Allen's species, though not typical.

Scotinomys longipilosus, new species

IRAZU LONG-HAIRED BROWN MOUSE

TYPE: A.M.N.H. No. 141223, adult male; Volcan Irazu, Costa Rica, 9400 feet elevation; collector, C. F. Underwood, August 22, 1941. Skin in good condition, skull complete except for basioccipital.

General Characters: A medium-sized, uniformly dark-colored *Scotinomys* with length of tail nearly equal to the combined length of head and body; pelage long, soft, and full, considerably longer on the head than height of the ears, in dried skin. Larger and darker in color than *Scotinomys irazu*. Similar to *Scotinomys xerampelinus* from Volcan Chiriqui but color darker and more tawny, tail longer, and skull more elongate.

Description: General color of upperparts nearly uniform Prout's Brown, darker on rump at base of tail, the fur Dark Neutral Gray from base for most of its length, tipped with Cinnamon-Brown and heavily mixed with long fine black guard hairs; color of underparts slightly paler than back and without the admixture of black guard hairs; fore and hind feet and tail Mummy Brown; ears blackish brown except for a few Cinnamon-Brown hairs on upper anterior border; hairs on lips and underside of mouth white. Skull long and slender, with a long narrow rostrum and slender nasals; braincase small, smooth, moderately inflated and constricted anteriorly; supraorbital ridges undeveloped; interorbital region narrow and inflated over orbits; zygomatic arches slender and not expanded, their sides parallel; interparietal narrow anteroposteriorly; anterior palatine foramina short and narrow, not quite reaching plane of anterior border of first molars; posterior border of palate squared and not drawn out into a median notch; bullae small but well inflated; nasals conterminous posteriorly with premaxillae. Masseteric process of the zygomatic plate only slightly developed and the plate elevated in front of the first molar.

Measurements: Total length, 151 mm.; tail vertebrae, 70; hind foot, 18 (dry, 18.5); ear, 13. Skull: greatest length, 22.3; length of nasals, 8.5; palatal length, 10.9; palatilar length, 9.8; mastoid width, 10.3; length of palatal slits, 3.3; zygomatic width, 11.2; greatest width of braincase, 10; interorbital width, 4.2; width across m^2–m^2, 5; alveoli of upper molar series, 4.

Scotinomys longipilosus is a medium-sized species with long soft fur, long tail, and needs no close comparison with races of the *teguina* group which have relatively close glossy pelage and a short tail. The underparts of *longipilosus* are only a shade lighter than its back; the color element being restricted and the hair long give a finely mixed cinnamon and dark gray effect. The skull is especially narrow in relation to its length, and the interorbital region is extended posteriorly, resulting in a small globular braincase and elimination of the supraorbital shelves. *S. longipilosus* resembles *xerampelinus* in the length of the pelage, but the element color is more cinnamon and the skull of the latter is broader and heavier with a much larger braincase.

The type of *longipilosus,* the only known specimen, was collected at a camp on the edge of the rain forest at an elevation of 9400 feet on Volcan Irazu. The dusky color and warm pelage of this species suggest a cool, moist habitat.

Scotinomys harrisi, new species

Savanna Brown Mouse

Type: U.M.M.Z. No. 62886, adult male, skin and skull, teeth unworn; Las Vueltas, Province of Cartago, Costa Rica; collected by Austin Smith, April 28, 1931. The type is the only known specimen and was taken on the savanna at an elevation of 8000 feet.

General Characters: A relatively large, buffy-colored *Scotinomys* of the *xerampelinus* group, with long, soft, full pelage and a comparatively short tail.

Description: Color of upperparts light Brussels Brown with little luster. The fur is Dark Neutral Gray from base for most of its length and broadly tipped with light Ochraceous-Tawny and sparsely mixed with long black hairs; cheeks and underparts clear Ochraceous-Buff; entire ear covered with fine Ochraceous-Tawny and black hairs, the light-colored hairs predominating. Feet, Mummy Brown but lightened by the presence of grayish brown hairs. The tail is exceptionally short and apparently complete. Skull large with a slender rostrum; nasals moderately long, narrow, tapered to a point posteriorly and extending slightly beyond the posterior border of the premaxillae; braincase high and well inflated, supraorbital shelf and parietal ridges undeveloped, interparietal moderately long anteroposteriorly but not extending across parietals, bullae well inflated but not unusually large; molariform teeth large, the last upper molar with a small but distinct posterior cusp, toothrows slightly divergent anteriorly. Anterior palatine foramina reaching to a line across the front of first molariform teeth, and interpterygoid fossa extending to a line across the posterior border of last molars. Masseteric process of the zygomatic plate barely indicated, and the plate elevated at a sharp angle in front of the first molar.

MEASUREMENTS OF TYPE: For comparison, the measurements of the type of *xerampelinus*, an old male, are in parentheses. Total length, 141 mm. (145); head and body, 83 (80); tail, 58 (65); hind foot, 19 (17); ear from crown, 12 (from notch, 14). Skull: greatest length, 22.8 (22.6); basal length, 18.2 (19.2); palatal length, 10.9; palatilar length, 9.7 (9.6); length of nasals, 8.75 (8.6); zygomatic width, 11.6 (11.6); mastoid width, 10.3 (10.8); interorbital width, 4.5 (4.2); width of braincase, 11; width of palate across first molars, 5.05; length of upper molar series, 4.2 (4); length of mandible, 12.7 (13).

Scotinomys harrisi is larger than *S. longipilosus* with a shorter tail and color element buffy instead of cinnamon. In cranial characters it differs from *longipilosus* in having a larger and broader skull, a noticeably larger braincase, larger teeth, and more divergent toothrow. Compared with *S. xerampelinus*, *harrisi* is larger with a shorter tail, and while the color element is of a similar shade it is much stronger, brighter, more uniform, and strongly accentuated over the ears, whereas in *xerampelinus* the ears are blackish. In cranial characters the skull of *harrisi* is similar to that of *xerampelinus* except that it has a more slender rostrum, higher braincase, slightly heavier teeth, and the last upper molar has a small but distinct subsidiary posterior cusp which probably disappears with wear. The two semi-adult topotypes of *xerampelinus* listed by Bangs do not have a similar cusp on this tooth.

The difference between *harrisi* and *xerampelinus* becomes more significant when the habitat and age of the two types are taken into consideration. The *harrisi* type is barely adult, with no signs of wear on the teeth, and was taken in savanna country at an elevation of 8000 feet. The *xerampelinus* type is an old male with much worn teeth and was taken on the desolate top of Volcan Chiriqui at an elevation of 10,800 feet in open rocky country, a little below timber line but where the forest had become stunted and sparse.

This species is named in honor of William P. Harris, Jr., whose scientific publications have added much to our knowledge of Central American mammals.

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NEW SPECIES OF POLYCHAETOUS ANNELIDS FROM MASSACHUSETTS AND CALIFORNIA

BY A. L. TREADWELL

Syllidae

TYPOSYLLIS LANGERHANS

Typosyllis aciculata, new species

Figures 1–5

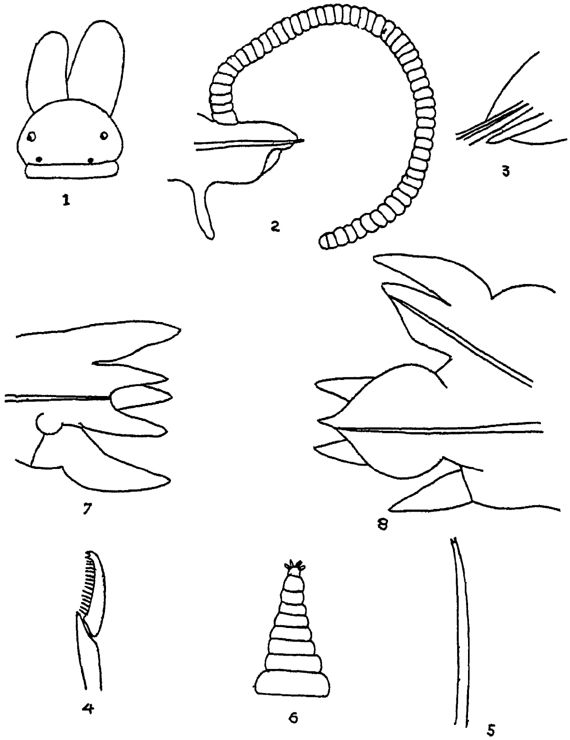
Two specimens collected on rocks near the laboratory at Pacific Grove, California, July 19, 1939. The type is 6 mm. long and about 0.4 mm. in greatest diameter, which is at about one-third of the body length posterior to the anterior end. The prostomium (fig. 1) is rounded on its anterior margin, its width being about twice its length. There are two pairs of eyes, the anterior pair being larger and farther apart than the posterior and provided with lenses. The palps are entirely separated at the bases and are asymmetrical in both specimens. In the type the left is the larger; in the other it is the right, the size difference being less in the type. Somite I is a little narrower than the prostomium, but the following ones widen so that at the twentieth somite they are twice as wide as the prostomium. The antennae and all dorsal cirri are distinctly moniliform (fig. 2). In both specimens the median antenna has been lost and so many cirri broken away that comparative measurements are of no value. In both specimens this breakage has been greatest in the median body region, so that there appears to be a grouping of cirri at both anterior and posterior ends. There is one pair of heavy anal cirri, each composed of about 16 joints.

The pharynx begins at the sixth setigerous somite and extends for six somites behind this. Its anterior margin is smooth, and there is a median tooth at its anterior end. The proventriculus extends through nine somites.

The increase in body width following the first somite is accompanied by an increase in somite length which continues to about the median body region, although the rate of increase diminishes after the first few somites. Most of the median body cirri have been lost, but what remain indicate that they are generally shorter than those at either end of the body. These latter are longer than the body diameter.

The parapodia (fig. 2) are roughly conical in outline, with an anterior and posterior lip and the dorsal portion overhanging the ventral. Figure 2 is a face view of a parapodium from the middle of the body showing the dorsal and ventral cirri, the former long and very distinctly moniliform, the latter inserted near the base of the parapodium and extending about halfway to its apex. Compound setae occur in each setigerous somite. The stems (fig. 4) have the usual truncated apices; the terminal joints are roughly triangular, each with an apical and a subapical tooth and a row of stiff spines along one margin. In posterior somites only, occur a simple form of seta which has about the same diameter as the basal joint of the compound and is very minutely bidentate at the apex (fig. 5). I have found only one of these in any one somite. In posterior somites occur very heavy aciculae lying dorsal to the setae and protruding from the surface. Figure 3 is a dorsal view of the parapodium showing the acicula and two stalks of the compound setae. I think that this acicula is not found in the most anterior somites. To determine this point would involve destroying so many parapodia on the single, type, specimen that it seemed not worth while. The other specimen had unfortunately partially dried during the study and was not available for this purpose.

[illegible]



Figs. 1–5. *Typosyllis aciculata*, new species. 1, Anterior end, X90; 2, parapodium, X27.5; 3, posterior parapodium, X180; 4, seta, X500; 5, seta, X250.

Figs. 6–8. *Goniada magna*, new species. 6, Head, X14; 7, anterior parapodium, X27.5; 8, posterior parapodium, X10.

The type is No. 3386 in the collections of the American Museum of Natural History.

Goniadidae

GONIADA AUDOUIN AND MILNE EDWARDS

Goniada magna, new species

Figures 6–8

A single incomplete specimen collected on Georges Bank, Massachusetts. The portion remaining is the anterior end and is 120 mm. long, with a width of 4 mm. The pharynx is protruded to a distance of 15 mm., and dissection shows that the invaginated portion is 6 mm. long, making a total pharynx length of 21 mm. On either side of the protruded pharynx is the characteristic row of black chevrons, about 21 in number and so closely packed together that it is difficult to determine the precise number. From the center toward either end of each row the individual chevrons gradually decrease in length so that the row has the form of an elongated narrow spindle. At the apex of the pharynx is a marginal row of about eight stout papillae. Proximal to these are two relatively large three-pronged denticles with numerous smaller denticles in rows around them. The larger pair have a diameter of about 0.75 mm. each.

The prostomium is 2 mm. long and composed of eight rings with four short tentacles at the apex (fig. 6). At the base it is 1 mm. wide. The peristomium is distorted due to the protrusion of the pharynx, but apparently its ventral surface length is about the same as that of the basal joint of the prostomium.

The change from the uniramous to the biramous form of parapodium takes place at about the ninetieth somite. The twenty-second parapodium (fig. 7) has a broadly lanceolate dorsal cirrus and a thicker but shorter ventral cirrus, the latter attached by a broad base to the ventral surface of the parapodium. The setal portion has three conical lobes, two posterior and one anterior, all of approximately the same size. There is a single stout acicula. The setae are all composite. Behind the region of the ninetieth somite a notopodium is added.

In the parapodia of this region (fig. 8), the anterior lobe of the setal portion of the neuropodium is broadly ovate with a pointed apex and is broader than the posterior lobe. The notopodium has an anterior and a posterior lobe, the latter shorter and more rounded than the former and does not show in the figure because concealed by it. The dorsal cirrus is heavy and longer than the setal portion. Each half of the parapodium has a large acicula.

In the anterior parapodia the setae are arranged in two bundles, one above and one below the setal lobes, all compound, heterogomph, the terminal joint not extending much beyond the apex of the parapodium. The notopodial setae in the posterior body region are all simple, very long, slender, and sharp pointed. The entire surface of each seta is finely sculptured with minute lines.

In the peculiar, closely packed, lateral chevron rows, the terminal papillae, and denticle arrangement this species shows a very close resemblance to Verrill's figure of *G. gracilis* (Hartman, "New England Annelida, Part 2," 1944, Bull. Amer. Mus. Nat. Hist., vol. 82, pl. 15, fig. 2), but no resemblances are noted in Verrill's description of the species (as *Oeone*) ("Invertebrates of Vineyard Sound," 1872, Rept. U. S. Commissioner of Fisheries, vol. 52, p. 596). A notable difference is that in Verrill's specimen the change from one to two branched parapodia takes place at the thirtieth somite.

Collected at latitude 40° 20′ N., longitude 67° 12′ W. in 300 meters depth by the "Albatross." The type is No. 3387 in the collections of the American Museum of Natural History.

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ADDITIONAL PHALANGIDA FROM MEXICO

BY CLARENCE J. AND MARIE L. GOODNIGHT

The present paper is a continuation of the studies of the authors on the phalangid fauna of Mexico (see Amer. Mus. Novitates, nos. 1163 and 1211, 1942, and 1249, 1944).

In this paper the writers have decided to recognize Soerensen's Stygnopsidae[1] placed as a subfamily, Stygnopsinae (Phalangodidae),[2] by Mello-Leitao. This subfamily is distinguished from Phalangodinae by the lack of the maxillary lobe of the second coxa and by having large open spiracles.

A discovery of interest is that of a new gonyleptid from western Mexico.

The writers are again indebted to Drs. C. Bolívar and F. Bonet of Mexico, D. F., for making these specimens available for study. These men were ably assisted in the finding of these animals by their colleagues Drs. D. Peláez, B. Osorio, M. Diaz, G. Tellez, J. Alvarez, M. Cárdenas, and M. Correa.

All holotypes of new species are deposited in the collection of the American Museum of Natural History. Paratypes are deposited in the collection of the American Museum of Natural History and in the personal collections of Drs. C. Bolívar and F. Bonet.

SUBORDER LANIATORES THORELL

PHALANGODIDAE Simon

Phalangodinae Roewer

GUERROBUNUS, NEW GENUS

Dorsum with five distinct areas, boundaries of areas parallel. Eye tubercle present, removed from the anterior margin of the cephalothorax, and unspined. Dorsal areas and free tergites without median armature. First dorsal area without a median line. Tarsal segments: 3-4-5-5. Distitarsus of first tarsus with two segments, of second, two segments.

GENOTYPE: *Guerrobunus minutus*, new species.

Guerrobunus differs from other genera of Phalangodinae in the number of tarsal segments, the number of segments in the distitarsi of the first and second tarsi, and the lack of spination of the eye tubercle.

Guerrobunus minutus, new species

Figures 1–3

FEMALE: Total length of body, 1.6 mm. Cephalothorax, 0.4 mm. Width of body at widest portion, 1.0 mm.

	I	II
Trochanter	0.1 mm.	0.12 mm.
Femur	0.6	0.90
Patella	0.3	0.40
Tibia	0 4	0.70
Metatarsus	0.4	0.60
Tarsus	0 4	0.90
Total	2.2 mm.	3.62 mm.

	III	IV
Trochanter	0.1 mm.	0.2 mm.
Femur	0.6	0.9
Patella	0.3	0.3
Tibia	0.4	0.7
Metatarsus	0.6	0.9
Tarsus	0.5	0.6
Total	2.5 mm.	3.6 mm.

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[1] Soerensen, Wm., 1932, K. Danske Videns. Selskabs Skr., ser. 9, vol. 3, p. 272.

[2] Mello-Leitao, C., 1938, Ann. Acad. Brasileira Sci., vol. 10, no. 2, pp. 135–137.

Dorsum coarsely granulate, all areas and free tergites without median armature. A transverse row of small tubercles across the posterior margin of the fifth area and each free tergite. Boundaries of the five areas parallel to one another, boundaries poorly delineated, marked only by slight depressions. First area without a median line. Eye tubercle rounded, covered with coarse granulations, slightly separated from the anterior margin of the cephalothorax, eyes at base. Anterior lateral margin of the cephalothorax with several small spinules on either side. A row of larger granulations along the lateral margin of the scute. Entire dorsum strongly arched. On the cephalothorax the arching gives the impression of a slight elevation posterior to the eye tubercle. Venter and coxae smooth, a transverse row of granulations across each free sternite. Anal operculum with small tuberculations. Third coxa with lateral teeth on the anterior and posterior margins, other coxae with granulations at the distal portions. First coxa with two larger tubercles on the distal anterior margin. Spiracles not visible.

Legs clothed throughout with scattered hairs; femora, patellae, and tibiae slightly roughened. Metatarsi not divided into calcaneus and astragulus, but with a slight constriction at the distal portion. Tarsal segments: 3-4-5-5. Distitarsus of first tarsus with two segments, of second, two segments. Proximal segment of the third and fourth tarsi somewhat longer than the other segments. The fourth tarsus on the left side of the paratype shows a reduced number of tarsal segments, but it is obvious that the proximal segment remained undivided. Third and fourth double tarsal claws simple, without scopulae.

Palpus: trochanter, 0.2 mm. long; femur, 0.5; patella, 0.4; tibia, 0.4; and tarsus, 0.4. Total length, 1.9 mm. Palpus armed retrolaterally as in figure 3; prolaterally the femur has an apical median spine; the patella has two large spine-bearing tubercles as well as many granulations; the tibia has four spine-bearing tubercles; and the tarsus has two large and one small spine-bearing tubercles. Entire dorsal surface of all segments but the tarsus tuberculate.

Chelicera normal, somewhat curved distally. Proximal segment with a tubercle at the proximal lateral margin, also with a slight elevation.

Entire animal and appendages light reddish. Tarsi of legs almost white. Eyes black, contrasting strongly.

Type Locality: Female holotype and female paratype from "El Resumidero" del Rio de San Jeronomo, Michapa, Guerrero, October 18, 1942 (C. Bolívar and C. Tellez).

MONTABUNUS, NEW GENUS

Dorsum with five distinct areas, boundaries not parallel. First area without a median line. All dorsal areas and free tergites without median armature. Eye tubercle removed from the anterior margin of the cephalothorax, unspined. Tarsal segments: 4-4-6-6. Distitarsus of first tarsus with two segments, of second, two.

Genotype: *Montabunus foliorum*, new species.

This genus is related to *Monterella* Goodnight and Goodnight, differing in the number of tarsal segments.

Montabunus foliorum, new species

Figures 4–6

Male: Total length of body, 2.4 mm Cephalothorax, 0.9 mm. Width of body at widest portion, 1.8 mm.

	I	II
Trochanter	0.2 mm.	0.3 mm.
Femur	1.0	1.4
Patella	0.4	0.5
Tibia	0.7	1.1
Metatarsus	0.9	1.0
Tarsus	0.6	1.2
Total	3.8 mm.	5.5 mm.

	III	IV
Trochanter	0.4 mm.	0.4 mm.
Femur	1.2	1.4
Patella	0.4	0.4
Tibia	1.0	1.2
Metatarsus	1.1	1.6
Tarsus	0.7	0.7
Total	4.8 mm.	5.7 mm.

Dorsum with five areas, first area without a median line, boundaries not parallel. Median portion of the third area extending caudad so as to separate the fourth area into two portions. Abdominal scute covered thickly with small tubercles except on the boundaries between the areas. In the median portions of areas I, II, and III, there is a slightly raised portion which is more thickly tuberculate. A transverse row of larger tubercles across the posterior margin of the fifth area and the free tergites. A larger obtuse tubercle on the lateral margin on the bulge in the region of area I. Cephalothorax not so heavily tuberculate as the abdomen. Anterior lateral margin of cephalothorax with a few very small projecting tubercles. Eye tubercle rounded, clearly separated from the anterior margin of the cephalothorax; tubercle thickly tuberculate, eyes at base. Venter and coxae roughly granulate. Anal operculum and free sternites with numerous small tubercles. Lateral teeth on the anterior and posterior margins of coxa III. Coxa IV with an internal dorsal distal spine. Spiracles hidden.

Legs clothed throughout with hairs. All segments but tarsi thickly covered with small, hair-tipped tubercles. Metatarsi not divided into astragulus and calcaneus. Trochanter III globular. Tarsal segments: 4-4-6-6. Distitarsus of first tarsus with two segments, of second, two segments. Last segment of second tarsus somewhat longer.

Palpus: trochanter, 0.3 mm. long; femur, 0.7; patella, 0.4; tibia, 0.5; and tarsus, 0.3. Total length, 2.2 mm. Palpus armed retrolaterally as in figure 4. Prolaterally the femur has a median apical spine, the patella has two spines, the tibia has four, and the tarsus has three. Dorsal portion of all segments but the tarsus tuberculate.

Chelicera normal, a very slight elevation on the dorsal portion of the proximal segment; with scattered hairs and small tubercles.

Dorsum reddish brown with darker brown mottlings on the cephalothorax, the lateral margins of the scute, and the median central portion of the areas. Venter concolorous with the dorsum. Appendages lighter yellowish red, with darker mottlings which are particularly prominent on the legs where they give a shaded appearance. Tarsi very light.

FEMALE: Total length of body, 2.6 mm. Cephalothorax, 0.9 mm. Width of body at widest portion, 2.1 mm.

Similar in appearance to male.

TYPE LOCALITY: Male holotype from woods of pines and oaks, Chipinque, Monterrey, Nuevo Leon, July 15, 1942 (C. Bolívar, F. Bonet, D. Peláez, and B. Osorio). Female paratypes from same locality, September 25, 1943 (F. Bonet).

Stygnopsinae Soerensen

Hoplobunus barretti Banks

Hoplobunus barretti BANKS, 1900, Jour. New York Ent. Soc., vol. 8, p. 200; ROEWER, 1912, Arch. Naturgesch., vol. 78, sect. A, no. 3, p. 149; 1923, Die Weberknechte der Erde, p. 112; GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, no. 1211, p. 1, figs. 1–6.

Spiracles widely expanded; the row of projections on the anterior margin of the first coxa are tubercles rather than lateral teeth. Maxillary lobes of the second coxae lacking. There is considerable variation in the size of the chelicera. The femur of the palpus lacks the median apical spine but has a dorsal apical one. Prolaterally the tibia and tarsus of the palpus are armed as on the retrolateral surface.

RECORDS: Mineral de El Chico, Hidalgo, forest of white fir at 2800 meters, under bark, June 27 and 28, 1943 (C. Bolívar, F. Bonet, B. Osorio, and D. Peláez).

Chinquipellobunus osorioi Goodnight and Goodnight

Chinquipellobunus osorioi GOODNIGHT AND GOODNIGHT, 1944, Amer. Mus. Novitates, no. 1249, p. 1, figs. 4–9.

RECORDS: Gruta Palmito, Bastamente, Nuevo Leon, September 15, 1942 (C. Bolívar), and Cueva Garcia, Nueva Leon, September 19, 1942 (C. Bolívar).

Serrobunus boneti Goodnight and Goodnight

Serrobunus boneti GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, no. 1211, p. 2, figs. 7–11.

RECORD: Cueva Pinta, Valles, San Luis Potosi, September 21, 1942 (C. Bolívar).

COSMETIDAE Simon

Cosmetinae Cambridge

COLIMA, NEW GENUS

Dorsum with five areas, first and second area with low paired tubercles, third area with paired small spines. Free tergites and remaining area without median armature. Basal segments of third and fourth legs enlarged over those of the first and second. Tarsal segments: 5-more than 6-6-more than 6. Distitarsus of first tarsus with three segments, of second, three segments.

GENOTYPE: *Colima multimaculata*, new species.

Colima differs from other genera of the subfamily Cosmetinae in the dorsal armature and in the number of tarsal segments.

Colima multimaculata, new species

Figures 12 and 13

MALE: Total length of body, 5.4 mm. Cephalothorax, 1.9 mm. Width of body at widest portion, 4.1 mm.

	I	II
Trochanter	0 5 mm.	0.5 mm.
Femur	1.8	3.6
Patella	0.7	1.0
Tibia	1.2	2.7
Metatarsus	1.9	3.7
Tarsus	1.4	2.5
Total	7 5 mm.	14.0 mm.

	III	IV
Trochanter	0.5 mm.	0.7 mm.
Femur	2 6	2.7
Patella	0.7	1.2
Tibia	1.4	2.5
Metatarsus	2.2	3.9
Tarsus	1.5	1 8
Total	8.9 mm.	12.8 mm.

Dorsum finely granulate, a pair of very low spines on the third area, paired tubercles on the first and second areas. These latter are so small as to be discernible only under high magnification. Remaining areas and free tergites without median armature. A transverse row of tubercles on the posterior portion of the fifth area and on the free tergites. The transverse row on the third free tergite larger. Eye tubercle low. Anterior lateral margin of the cephalothorax with one or two small projections. Venter and coxae granulate, anal operculum with scattered tubercles. A transverse row of small tubercles across the first coxa. The free sternites with only a transverse row of very small granulations. Coxae without lateral teeth. Fourth coxa widened, ventral portion with a large tubercle on either side just anterior to the stigmen. Fourth coxa with a dorsal distal spinous projection.

Legs clothed throughout with hairs. Fourth trochanter with a distal retrolateral spine. Third and fourth femora curved, fourth curved most strongly. Fourth femur very roughly granulate with heavy tuberculations at the distal portion. These are arranged in several rows. Distal portion of femora heavier. Fourth patella and tibia tuberculate. Retrolateral margin of tibia with five or six larger tubercles. Metatarsus with a row of tubercles, which are small, on the retrolateral margin. Basal segments of third and fourth legs slightly heavier than those of the first and second. Tarsal segments: 5-8 to 12-6-7. Distitarsus of first tarsus with three segments, of second, three segments. Basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.5 mm. long; femur, 1.2; patella, 0.7; tibia, 1.0; and tarsus, 0.5. Total length, 3.9 mm. Palpus characteristically flattened, a row of tubercles on the ventral margin of the femur.

Chelicera enlarged slightly. Proximal segment tuberculate.

Dorsum reddish brown, intricately mottled with darker brown; darker markings are more numerous at the posterior portion. Scattered pencilings of white over the entire dorsum including the free tergites. White markings more numerous at the posterior and lateral portions. White dottings at the lateral portions of the cephalothorax. Occasionally there are white markings on the free sternites. Venter, coxae, and appendages reddish brown, fourth leg somewhat darker.

FEMALE: Total length of body, 5.5 mm. Cephalothorax, 1.8 mm. Width of body at widest portion, 4.1 mm.

Similar in appearance to male, but with reduced tuberculations on the legs. Size of chelicera is smaller, and the basitarsus of tarsus I not enlarged. The ventral tubercle of the fourth coxa is extremely reduced.

TYPE LOCALITY: Male holotype and male and female paratypes from Colima, Colima, January 21, 1943 (F. Bonet).

In some specimens the spines of the third area are large, and in other individuals they are reduced almost to tubercles. There is considerable variation in the amount of white pencilings. In some specimens there is very little. One specimen has a nearly complete white V at the junction of the cephalothorax and abdomen. One specimen has only six segments in the tarsus of the fourth leg.

Cynorta cardenasi, new species

Figure 11

MALE: Total length of body, 4.5 mm. Cephalothorax, 1.6 mm. Width of body at widest portion, 4.0 mm.

	I	II
Trochanter	0.4 mm.	0.4 mm.
Femur	2.2	5.8
Patella	0.7	1.0
Tibia	1.5	4.9
Metatarsus	2.6	5.9
Tarsus	1.6	2.8
Total	9.0 mm.	20.8 mm.

	III	IV
Trochanter	0.5 mm.	0.8 mm.
Femur	4.0	7.3
Patella	1.0	1.1
Tibia	2.3	4.8
Metatarsus	3.8	7.7
Tarsus	1.7	2.2
Total	13.3 mm.	23.9 mm.

Dorsum finely granulate, paired tubercles on the first area, paired spines on the third. Remaining areas and free tergites without median armature. Spines of the third area slightly curved caudad. A few very small tubercles in the median portion of the fourth area. A transverse row of small tuberculations on the posterior portion of the fifth area and each free tergite. Eye tubercle low, normal. Anterior margin of cephalothorax with the characteristic projections enclosing the chelicerae. Venter and coxae granulate with scattered hairs. Each free sternite with a transverse row of granulations. An enlarged tubercle at the lateral margin of the second and third free sternites. Anal operculum granulate, fourth coxa somewhat widened, lateral surface visible from above. This surface is tuberculate. Fourth coxa with a large distal dorsal spine which projects over the fourth trochanter. Trochanters granulate, a distal posterior spine on the third and fourth trochanters. The spine on the fourth is large and curved.

Legs with small scattered hairs; femora, patellae, and tibiae with small tuberculations. Basal segments of third and fourth legs not enlarged. Fourth femur straight. Tarsal segments: 6-11-7-7. Distitarsus of first tarsus with three segments, of second, three segments. Basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.4 mm. long; femur, 1.0; patella, 0.5; tibia, 1.0; and tarsus, 0.4. Total length, 3.3 mm. Palpus characteristically flattened. Femur with a ventral row of sharp tuberculations. Tibia with a less prominent ventral row.

Chelicera very slightly enlarged. Proximal segments with numerous tuberculations.

Dorsum reddish brown, with a white pattern as follows: a V between the cephalothorax and abdomen, each arm ends in a lateral spot; a broken median line from the V to the posterior portion of the third area where it joins a bowed transverse line; a penciled line in the median portion of the posterior part of the first and second areas; an irregular marking in the median portion of the fourth area; a few scattered spots at the lateral portion of the scute. No white markings on the free tergites. Venter and coxae reddish brown, appendages somewhat lighter with darker mottlings.

TYPE LOCALITY: Male holotype from Acapulco, Guerrero, July 24, 1943 (M. Cárdenas). Found among the leaves of a bush.

Cynorta cardenasi is related to *C. skwarrae* Roewer, differing in the dorsal color pattern and in having tuberculations on the free tergites. Also the fourth and third femora are straight.

Cynorta fortina, new species

Figure 8

Male: Total length of body, 5.1 mm. Cephalothorax, 1.2 mm. Width of body at widest portion, 1.2 mm.

	I	II
Trochanter	0.4 mm.	0.6 mm.
Femur	3 2	7.5
Patella	0.9	1.4
Tibia	2.1	5.9
Metatarsus	3.6	8.1
Tarsus	2.4	4.5
Total	12.6 mm.	28.0 mm.

	III	IV
Trochanter	0.9 mm.	1.1 mm.
Femur	5.6	7.5
Patella	1.4	1.4
Tibia	5.2	7.6
Metatarsus	3.2	4.6
Tarsus	3.0	3.4
Total	19.3 mm.	25.6 mm.

Dorsum finely granulate, paired tubercles on the first area, paired spines on the third. Spines of the third area medium in size. Remaining areas and free tergites unbedecked. Free tergites without tuberculations. Coxae and venter finely granulate. A transverse row of tubercles across the first coxa, a few lateral teeth on the anterior and posterior margins of the third coxa.

Legs clothed throughout with scattered hairs. Legs almost smooth, with only a few granulations on the proximal segments. Fourth femur straight. Distal portion of fourth tibia swollen. Tarsal segments: 6-14-9-10. Distitarsus of first tarsus with three segments, of second, three segments. Basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.6 mm. long; femur, 1.3; patella, 0.9; tibia, 1.2; and tarsus, 0.7. Total length, 4.7 mm. Palpus characteristically flattened. Femur with a ventral row of teeth.

Chelicera normal, a few granulations on the proximal segment.

Dorsum reddish brown with darker mottlings particularly on the lateral margins of the scute and on the posterior portion of the scute. Paired tubercles and spines very dark. A white V between the cephalothorax and abdomen, the arms of the V ending in an irregular white spot in the region of the second and third coxae; a broken median white line connects with a transverse white line just posterior to the spines. On either side a lateral line irregularly connects the anterior spot with the transverse posterior line. Irregular white markings on the fourth and fifth areas, free tergites without markings. Venter and coxae reddish brown. Palpi and chelicerae yellowish with much dark mottling. Legs yellow with black markings which give a mottled appearance particularly on the femora, patellae, and tibiae.

Female: Total length of body, 5.1 mm. Cephalothorax, 1.2 mm. Width of body at widest portion, 4.1 mm.

Female similar to male except that it lacks the enlarged distal portion of the fourth tibia and the basitarsus of the first tarsus.

Type Locality: Male holotype and male and female paratypes from Fortin, Vera Cruz, July 25, 1943 (C. Bolívar).

This species differs from other members of the genus *Cynorta* by having a distinctive dorsal color pattern.

Metavonones hispidus Cambridge

Metavonones hispidus Cambridge, 1904, Biologia Centrali-Americana, Arachnida, vol. 2, p. 553, pl. 52, fig. 6, 6a, 6b; Roewer, 1923, Die Weberknechte der Erde, p. 308; Goodnight and Goodnight, 1942, Amer. Mus. Novitates, no. 1211, p. 4, fig. 20.

Records: Taxco, Guerrero, August 15, 1943 (C. Bolívar, D. Peláez, and B. Osorio); Oaxtepec, Morelos, July 4, 1943 (B. Osorio, M. Diaz, C. Bolívar); and Malinalco, Mexico, August 8, 1943 (C. Bolívar).

Michella hoogstraali Goodnight and Goodnight

Michella hoogstraali Goodnight and Goodnight, 1942, Amer. Mus. Novitates, no. 1211, p. 5, fig. 14.

Record: Uruapan, Michoacan, April 24, 1943 (M. Cárdenas and M. Correa). Found in a garden under stones.

GONYLEPTIDAE Sundevall

Pachylinae Roewer

PROSONTES, NEW GENUS

Dorsal scute with five areas. Eye tubercle not on the anterior margin of the cephalothorax, unspined, but with small tuberculations. All areas and free tergites without median armature. Anal operculum unbedecked. Femur of palpus without dorsal apical or median apical spine. Tarsal segments: 4-more than 6-5-5. Distitarsus of first tarsus with three segments, of second, three segments. Third and fourth tarsi without scopulae, double claws simple.

Genotype: *Prosontes phalattes*, new species.

This genus is related to *Progyndes* Roewer, differing in the number of tarsal segments and the lack of the spine over the eye.

Prosontes phalattes, new species

Figures 14–16

Male: Total length of body, 3.7 mm. Cephalothorax, 1.1 mm. Width of body at widest portion, 2.9 mm.

	I	II
Trochanter	0.4 mm.	0.4 mm.
Femur	1.2	1.9
Patella	0.4	0.5
Tibia	0.7	1.2
Metatarsus	1.0	1.6
Tarsus	0.9	1.5
Total	4.6 mm.	7.1 mm.

	III	IV
Trochanter	0.4 mm.	0.5 mm.
Femur	1.5	1.6
Patella	0.5	0.8
Tibia	1.0	1.6
Metatarsus	1.4	2.3
Tarsus	0.8	1.0
Total	5.6 mm.	7.8 mm.

Dorsum with five distinct areas. All areas and free tergites without median armature. Areas I to IV each with a transverse row of several small tubercles. These tubercles are extremely reduced on the first area. Fifth area and free tergites with a complete transverse row of prominent tubercles. First area without a median line. A row of tubercles on the lateral margin of the scute in the region of the abdominal bulge. Third area wider than the cephalothorax. Entire dorsum granulate. Eye tubercle unbedecked, but with small tuberculations. Dorsal portion of anal operculum thickly covered with globose tuberculations. Each free sternite with a transverse row of tuberculations. Coxae granulate. Fourth coxae widened laterally. Lateral portion with numerous tuberculations which are visible from above. Fourth coxa ends in a large distal spine.

Legs with scattered hairs. Femora, patellae, and tibiae with tuberculations. These tuberculations are larger on the third and fourth legs. Third and fourth femora curved. Fourth trochanter with a retrolateral tubercle, fourth femur very heavily tuberculate, with several larger tuberculations on either side at the distal portion, the largest one being on the retrolateral margin. Fourth patella and tibia thickly tuberculate. All metatarsi with a suggestion of a false articulation at the distal portion. Tarsal segments: 4-7-5-5. Distitarsus of first tarsus with three segments, of second, three segments. The holotype has six segments on the second tarsus on the right side; however, all other specimens had seven on both sides. Tarsal claws simple; no scopulae. Basitarsus of first tarsus somewhat enlarged.

Palpus: trochanter, 0.4 mm. long; femur, 0.7; patella, 0.5; tibia, 0.5; and tarsus, 0.4. Total length, 2.5 mm. Palpus armed retrolaterally as in figure 15. Prolaterally unarmed except for the ventral projection on the tarsus, which is visible in the figure. Femur without dorsal apical or median apical spines. Femur and tibia somewhat flattened, distal segments with scattered hairs.

Chelicera normal, with scattered hairs, proximal segment slightly enlarged and with granulations.

Dorsum reddish brown with much darker brown mottling. Areas are outlined in lighter coloring. There is much lighter mottling on the cephalothorax including the median portion of the eye tubercle which contrasts with the darker area around each eye. Venter and coxae reddish brown; chelicera, palpus, and legs I to III yellowish with much dark brown mottling. Fourth leg, except tarsus, reddish brown with dark mottlings. Tarsus lighter.

Female: Total length of body, 3.9 mm.

Cephalothorax, 1.3 mm. Width of body at widest portion, 2.9 mm.

Female similar in appearance to male. Distal spine of the fourth coxa much reduced, basitarsus of first tarsus not enlarged. Tuberculations of the fourth leg much reduced. Palpus much flattened (see fig. 16) and lacking the tarsal spur; femur with prominent ventral teeth. One female specimen had five segments in the tarsus of the first leg.

Type Locality: Male holotype and male and female paratypes from Colima, Colima, January 21, 1943 (F. Bonet).

SUBORDER PALPATORES THORELL

Tribe **DYSPNOI** Hansen and Soerensen

TROGULIDAE Simon

Trilasma bolivari Goodnight and Goodnight

Trilasma bolivari Goodnight and Goodnight, 1942, Amer. Mus. Novitates, no. 1211, p. 7, figs. 16–18.

Records: Rio Paso de Cortes, Pueblo, 3000 meters, July 18, 1943 (C. Bolívar); Nevada de Colima, Jalisco, woods of oak and pine, January 21, 1943 (F. Bonet); Mineral de El Chico, Hidalgo, woods of white fir, under bark, 2800 meters, June 27, 1943, also 3100 meters, June 28, 1943 (F. Bonet, C. Bolívar, and B. Osorio); and Salazar, D. F., September 30, 1942 (M. Cárdenas).

Tribe **EUPNOI** Hansen and Soerensen

PHALANGIIDAE Simon

Leiobuninae Banks

Leiobunum alvarezi, new species

Figure 19

Male: Total length of body, 3.1 mm. Cephalothorax, 1.1 mm. Width of body at widest portion, 2.1 mm. Length of femora: I, 6.8 mm.; II, 11.1 mm.; III, 7.1 mm.; IV, 7.5 mm.

Dorsum granulate, eye tubercle in the median portion of the cephalothorax, canaliculate, smooth above. Supracheliceral lamella in the form of an expanded plate. Venter granulate, coxae coarsely granulate with rows of teeth on the anterior and posterior margins of all coxae.

Legs clothed throughout with hairs. Small dark spines present on the trochanters, femora, and patellae. Metatarsi with false articulations.

Palpus: trochanter, 0.3 mm. long; femur, 1.1; patella, 0.4; tibia, 0.8; and tarsus, 1.0. Total length, 3.6 mm. Palpus clothed throughout with hairs, a row of spines on the ventral margin of the femur. Femur not extended above the cephalothorax. Patella without apophysis.

Chelicera normal, with scattered hairs.

Penis alate.

Dorsum dark brown with a subobsolete broad median stripe on the abdomen and a suggestion of light punctations across each abdominal segment and the last thoracic segment. Lateral portion of cephalothorax lighter. Median portion dark. Eye tubercle, except at base, dark; a ring of black around each eye. Venter and coxae light brown. Trochanters and bases of femora dark brown, contrasting, remainder of legs golden brown. Palpus and chelicera yellowish. Palpus with some darker mottlings.

One male was much smaller than the holotype, being only 2.5 mm. in total length.

Female: Total length of body, 3.2 mm. Cephalothorax, 1.2 mm. Width of body at widest point, 2.7 mm.

Female similar in appearance to male.

Type Locality: Male holotype and male and female paratypes from Cuernavaca, Morelos, May 1, 1942 (J. Alvarez). Paratypes from Oaxtepec, Morelos, July 11, 1943 (C. Bolívar and B. Osorio).

This species differs from other members of the genus *Leiobunum* by having a distinctive dorsal color pattern.

Leiobunum bogerti Goodnight and Goodnight

Leiobunum bogerti Goodnight and Goodnight, 1942, Amer. Mus. Novitates, no. 1163, p. 11, figs. 25, 27.

RECORD: Palo Alto, Jalisco, found on cultivated land on stones (F. Bonet).

Leiobunum bolivari, new species

Figure 18

MALE: Total length of body, 3.2 mm. Cephalothorax, 1.2 mm. Width of body at widest portion, 2.2 mm. Length of femora: I, 8.7 mm.; II, 13.2 mm.; III, 9.7 mm.; IV, 11.2 mm.

Dorsum granulate, eye tubercle at the posterior portion of the cephalothorax, only very slightly canaliculate, smooth above. Supracheliceral lamella in the form of a pointed projection. Venter and coxae smooth, with a few scattered hairs. Lateral teeth present on anterior and posterior margins of all coxae.

Legs with scattered hairs, and with numerous small dark spines on the femora. Metatarsi with false articulations.

Palpus: trochanter, 0.2 mm. long; femur, 1.1; patella, 0.5; tibia, 0.6; and tarsus, 1.0. Total length, 3.4 mm. Femur with scattered hairs, similar hairs more numerous on the tibia and tarsus. Patella without apophyses. Femur not extended above the height of the cephalothorax.

Chelicera normal, with scattered hairs.

Penis alate.

Dorsum shimmering, metallic, varying from reddish gold to green depending on the direction of the light. Eye tubercle white, with a black ring around each eye. A strip of white along the anterior margin of the cephalothorax. A transverse row of small white punctations on the posterior segment of the cephalothorax. An irregular dorsal stripe of lighter grayish extending from the eye tubercle to the posterior portion of the abdominal scute. There are many white punctations scattered in this lighter area. Venter and coxae grayish, almost white. There are some brown mottlings, and the lateral teeth of the coxae are dark brown contrasting strongly with the gray of the coxae. Trochanters and bases of femora very dark brown, contrasting strongly with the coxae. Remainder of legs lighter, golden brown. Palpus light yellowish brown, a few darker brown mottlings on the femur and patella. Chelicera concolorous with the palpus.

FEMALE: Total length of body, 4.0 mm. Cephalothorax, 1.3 mm. Width of body at widest portion, 2.2 mm.

Identical in appearance with male.

TYPE LOCALITY: Male holotype and male and female paratypes from Michapa, Guerrero, October 24, 1942 (C. Bolívar).

Leiobunum bolivari is related to *L. viridorsum* Goodnight and Goodnight, differing in the color of the dorsum and by having contrasting teeth on the coxae.

Leiobunum bruchi Mello-Leitao

Figure 21

Leiobunum bruchi MELLO-LEITAO, 1933, Ann. Acad. Brasileira Sci., vol. 5, p. 100, figs. 3, 4.

MALE: Total length of body, 4.4 mm. Cephalothorax, 1.4 mm. Width of body at widest portion, 2.7 mm. Length of femora: I, 6.7 mm.; II, 11.3 mm.; III, 6.6 mm.; IV, 9.2 mm.

Dorsum granulate, eye tubercle in the median portion of the cephalothorax, slightly canaliculate, smooth above. Supracheliceral lamella in the form of an expanded plate. Venter and coxae smooth, free sternites with transverse rows of larger granulations. Lateral teeth of coxae poorly developed, lacking on the posterior margins of coxae I and II.

Legs with spine-like hairs on the femora, patellae, and tibiae, larger on the femora. Metatarsi with false articulations.

Palpus: trochanter, 0.3 mm. long; femur, 1.3: patella, 0.6; tibia, 0.9; and tarsus, 1.1. Total length, 4.2 mm. Palpus clothed throughout with scattered hairs. Spine-like hairs present on the ventral and dorsal portions of all segments. Patella without apophyses. Femur does not extend above the surface of the eye tubercle.

Chelicera normal, with scattered hairs, a small tubercle at the proximal portion of the second segment.

Penis alate.

Dorsum dark brown, dorsal and caudal portions of the eye tubercle white. From the eye tubercle a broken median line, varying from light yellowish to white, extends to the distal portion of the dorsum where it widens into two white spots, one on each of the two free tergites. A ring of white around the opening of each stink gland. Lateral portion of the abdomen and venter buff. Ventral part of venter, genital operculum, and coxae with much darker brown so as to appear only slightly lighter than the dorsum. Trochanters and bases of femora dark brown, somewhat darker than the coxae, but not contrasting. Legs light brown, femora with pale indefinite rings. Palpus: femur, patella, and tibia, and most of tarsus brownish, distal portion of tarsus yellowish. Chelicera yellowish, with much darker brown mottlings, particularly at the distal portion, proximal segment with a large dorsal brown spot.

RECORD: La Blanca, Tlalnepantla, Mexico, August 22, 1943 (C. Bolívar and B. Osorio).

Leiobunum colimae, new species

Figure 10

MALE: Total length of body, 4.4 mm. Cephalothorax, 1.3 mm. Width of body at widest portion, 2.8 mm. Length of femora: I, 8.7 mm.; II, 12.8 mm.; III, 8.6 mm.; IV, 11.1 mm.

Dorsum granulate, eye tubercle in the median portion of the cephalothorax, slightly canaliculate, smooth above except for a few minute tubercles; eye tubercle straight in front. Supracheliceral lamella in the form of an expanded plate. Venter granulate, a transverse row of granulations on each free sternite. Genital operculum and coxae roughly granulate. Lateral rows of teeth on the anterior and posterior margins of each coxa.

Legs with scattered hairs. Trochanters, femora, and patellae with small black spines. Metatarsi with false articulations.

Palpus: trochanter, 0.3 mm. long; femur; 1.1; patella, 0.5; tibia, 0.6; and tarsus, 1.0. Total length, 3.5 mm. Palpus with scattered hairs which are more numerous and longer on the tarsus. Ventral and distal portions of femur and entire patella with brown spinules. Patella without apophyses. Femur not extending above the surface of the cephalothorax.

Chelicera normal, with scattered hairs.

Penis alate.

Eye tubercle dark, brown above, lighter at base and in median furrow. Cephalothorax posterior to the eye tubercle and dorsal portion of abdomen dark brown, somewhat metallic. Remainder of cephalothorax and lateral portion of abdomen yellowish. Cephalothorax with darker shadings. Venter and coxae yellowish, trochanters brownish, somewhat darker than the coxae, but not contrasting. Anterior and posterior portions of trochanters darker than the lateral portions. Legs brownish, darker distally. Palpus and chelicera yellowish, somewhat darker at base.

FEMALE: Total length of body, 5.6 mm. Cephalothorax, 1.4 mm. Width of body at widest portion, 4.1 mm.

Identical in appearance with the male.

TYPE LOCALITY: Male holotype and male and female paratypes from Laguna del Alcuzahue, Tecoman, Colima, collected in a crevice of a cliff, January 19, 1943 (F. Bonet). Male paratypes from Fortin, Vera Cruz, August 25, 1943 (C. Bolívar).

This species differs from other members of the genus *Leiobunum* in its general appearance and coloration.

Leiobunum consimile Banks

Leiobunum consimile BANKS, 1900, Jour. New York Ent. Soc., vol. 8, p. 199; CAMBRIDGE, 1904, Biologia Centrali-Americana, Arachnida, vol. 2, p. 585.

Leiobunum dugesi BANKS, 1908, Proc. Ent. Soc. Washington, vol. 9, p. 37.

Leiobunum consimile ROEWER, 1910, Abhandl. Ver. Hamburg, vol. 19, no. 4, p. 232; 1923, Die Weberknechte der Erde, pp. 906–907.

RECORDS: Malinalco, Mexico, August 8, 1943 (C. Bolívar); Taxco, Guerrero, August 1, 1943 (C. Bolívar, D. Peláez, and B. Osorio); Potrero Grande, January 15, 1943 (F. Bonet).

Leiobunum desertum Goodnight and Goodnight

Leiobunum desertum GOODNIGHT AND GOODNIGHT, 1944, Amer. Mus. Novitates, no. 1249, p. 9, fig. 23.

RECORD: Oaxtepec, Morelos, July 4, 1943 (C. Bolívar, B. Osorio, M. Diaz).

Leiobunum nigrigenum, new species

Figure 22

MALE: Total length of body, 3.8 mm. Cephalothorax, 1.3 mm. Width of body at widest portion, 3.2 mm. Length of femora: I, 7.7 mm.; II, 13.1 mm.; III, 7.8 mm.; IV, 12.3 mm.

Dorsum granulate, eye tubercle in the median portion of the cephalothorax, slightly canaliculate, smooth above except for scattered hairs. Supracheliceral lamella in the form of an expanded plate, with a slight median projection. Venter finely granulate, with scattered hairs. Coxae roughly granulate. Lateral teeth present on the anterior margins of all coxae and on the posterior margin of coxa IV. Teeth also present on the lateral margins of the genital operculum.

Legs long, with numerous small hairs which are more or less arranged in rows, otherwise smooth.

Palpus: trochanter, 0.3 mm. long; femur, 1.5; patella, 0.6; tibia, 1.1; and tarsus, 1.7. Total length, 5.2 mm. Palpus clothed throughout with hairs, large spine-like hairs present on the ventral and dorsal portions of all segments. These are particularly numerous on the ventral margin of the tibia. Proximal section of tibia swollen. Patella without apophyses. Femur not extended above the eye tubercle.

Chelicera normal, second segment with many spine-like hairs.

Penis alate.

Dorsum reddish brown, with a slightly darker median stripe extending from the anterior margin, enclosing the eye tubercle, narrowing at the anterior portion of the abdomen, and widening posteriorly. Eye tubercle black, lighter at base. Venter lighter reddish, coxae darker, mottled with black distally. Trochanters and bases of femora black, contrasting, legs dark brown, lighter distally. Femur of palpus mottled with dark brown, very dark at the distal tip. Patella dark, proximal portion of tibia somewhat lighter, mottled, distal two-thirds of tibia and the tarsus very much lighter. Chelicera light, claw tipped with black.

FEMALE: Total length of body, 5.7 mm. Cephalothorax, 1.4 mm. Width of body at widest portion, 3.7 mm.

Similar in appearance to male.

TYPE LOCALITY: Male holotype from Huatusco, Vera Cruz, October 11, 1943 (M. Cárdenas). Male and female paratypes from same locality.

This species differs from other members of the genus *Leiobunum* by having a distinctive color pattern.

Leiobunum nycticorpum Goodnight and Goodnight

Leiobunum nycticorpum GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, no. 1163, p. 11, figs. 25, 27.

RECORD: Palo Alto, Jalisco, cultivated land (F. Bonet).

Leiobunum tascum, new species

Figure 9

FEMALE: Total length of body, 5.1 mm. Cephalothorax, 1.6 mm. Width of body at widest portion, 2.6 mm. Length of femora: I, 6.9 mm.; II, 9.7 mm.; III, 6.8 mm.; IV, 9.1 mm.

Dorsum granulate, eye tubercle in the median portion of the cephalothorax, slightly canaliculate, smooth above. Venter smooth, coxae granulate. Supracheliceral lamella in the form of an expanded plate. Rows of poorly developed teeth on the anterior and posterior margins of all coxae.

Legs: femora and patellae with small dark spines, remainder of legs smooth, metatarsi with false articulations.

Palpus: trochanter, 0.3 mm. long; femur, 1.2; patella, 0.5; tibia, 0.8; and tarsus, 1.3. Total length, 4.1 mm. Palpus with scattered hairs. Small dark spines on the distal portion of the femur, patella, and proximal portion of the tibia. A row of spine-like hairs on the ventral proximal portion of the femur, apical median portion of the patella with a small but distinctive apophysis. Teeth of tarsal claw poorly developed. Femur not extending above the surface of the cephalothorax.

Chelicera normal, with scattered hairs.

Dorsum brownish, darker brown median stripe beginning at the anterior margin of the cephalothorax and extending to the posterior margin of the abdomen. A lighter brown area on either side of the abdominal portion of the central stripe. Lateral portion of dorsum pale. Entire dorsum posterior to the eye tubercle with numerous light punctations, somewhat masked in the lighter area. Eye tubercle dark at the base and in the median sulcus, white around both eyes. Venter and coxae light buff. Trochanters I to III with dark brown areas, particularly on the anterior and posterior portions. These appear to contrast somewhat with the coxae. Trochanter IV not contrasting. Bases of femora dark brown, remainder of legs light brown, darker distally. Palpus and chelicera light, concolorous with the venter. Tips of cheliceral claws dark.

TYPE LOCALITY: Female holotype from Taxco, Guerrero, August 15, 1943 (C. Bolívar, B. Osorio, and D. Peláez).

This species is closely related to *L. desertum* Goodnight and Goodnight, differing in having an apophysis on the patella of the palpus and in the dorsal color pattern.

Nelima tancitaro Goodnight and Goodnight

Nelima tancitaro GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, no. 1211, p. 10, fig. 22.

RECORD: Colorines, Mexico, July 18, 1943 (B. Osorio).

In one specimen, the dorsal stripe has narrowed to a line which is continuous with that of the eye tubercle. The dorsum of this animal is darker than that of the holotype.

Paranelima albalineata Goodnight and Goodnight

Paranelima albalineata GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, no. 1211, p 10, fig. 24.

RECORD: National Park, "El Chico," Hidalgo, 3000 meters, May 11, 1943 (C. Bolívar).

Paranelima correa, new species

Figure 20

MALE: Total length of body, 3.7 mm. Cephalothorax, 1.2 mm. Width of body at widest portion, 2.2 mm. Length of femora: I, 3.1 mm.; II, 5.1 mm.; III, 3.4 mm.; and IV, 4.7 mm.

Dorsum roughly granulate; eye tubercle in the median portion of the cephalothorax, smooth above except for dorsal granulations, only slightly canaliculate, compressed. Supracheliceral lamella extended into a short spine. Venter almost smooth. Coxae and genital operculum with many small black spines which are particularly numerous on the lateral margins. Coxae without lateral teeth.

Legs: trochanters with dark spinules on the lateral margins; femora, patellae, and trochanters granulate with very small spines. Metatarsi and tarsi with small hairs. Metatarsi with false articulations.

Palpus: trochanters, 0.2 mm. long; femur, 0.7; patella, 0.4; tibia, 0.5; and tarsus, 0.7. Total length, 2.5 mm. Palpus with scattered hairs. Femur, patella, and tibia thickly covered with small dark spines. Patella with a very short median apophysis. Tarsal claw toothed.

Chelicera normal, with a few scattered hairs.

Dorsum buff, with a darker brownish median stripe extending from the anterior margin, widening in the region of the eye tubercle, and narrowing on the abdomen. On the abdomen, there is a somewhat lighter area bordering the stripe and merging into the extremely light lateral portion. Eye tubercle concolorous with the dorsum. Venter light, coxae light except for the lateral margins which are brown. Legs: trochanters and bases of femora light except for the lateral portion of the third and fourth which are brown; remainder of legs light brown with many darker brown mottlings. Palpus yellowish with much darker brown mottling on the femur, patella, and tibia. Chelicera very light, claws tipped with black.

TYPE LOCALITY: Male holotype from Uruapan, Michoacan, under stones, April 24, 1943 (M. Correa).

Paranelima correa differs from *P. lutzi* Goodnight and Goodnight by having a longer and more granulate body and by having a different dorsal color pattern.

Paranelima lutzi (Goodnight and Goodnight)

Glabrurus lutzi GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, no. 1163, p. 14, fig. 21.

Paranelima lutzi GOODNIGHT AND GOODNIGHT 1942, Amer. Mus. Novitates, no. 1211, p. 11.

Record: National Park, "El Chico," Hidalgo, 2800 meters, June 28, 1943 (C. Bolívar, B. Osorio, F. Bonet, and D. Peláez).

Phalangiinae Simon

Diguetinus spinulatus (Banks)

Leptobunus spinulatus Banks, 1898, Jour. New York Ent. Soc., vol. 6, p. 182; Roewer, 1910, Abhandl. Ver. Hamburg, vol. 19, no. 4, p. 257.

Diguetinus raptator Roewer, 1912, Abhandl. Ver. Hamburg, vol. 20, no. 1, p. 272, pl. 1, fig. 25; 1923, Die Weberknechte der Erde, p. 863, fig. 1030.

Hadrobunus spinulatus Roewer, 1923, Die Weberknechte der Erde, p. 920.

Diguetinus spinulatus Goodnight and Goodnight, 1942, Amer. Mus. Novitates, no. 1211, p. 11.

Record: Presa de Guadalupe, Mexico, August 22, 1943 (C. Bolívar and B. Osorio).

Metopilio albispinulatus Goodnight and Goodnight

Metopilio albispinulatus Goodnight and Goodnight, 1944, Amer. Mus. Novitates, no. 1249, pp. 9, 10, fig. 21.

Records: El Xitle, Mexico, D. F., October 12, 1942, (C. Tellez); Oaxtepec, Morelos, November 7, 1943 (C. Bolívar and B. Osorio).

Metopilio armigerum (Cambridge)

Phalangium armigerus Cambridge, 1904, Biologia Centrali-Americana, Arachnida, vol. 2, p. 479, pl. 54, figs. 8, 8a, 9, 9a.

Metopilio armigerum Roewer, 1923, Die Weberknechte der Erde, p. 858.

Records: El Parque, Morelos, August 28, 1943 (M. Cárdenas); Taxco, Guerrero, August 15, 1943 (C. Bolívar, D. Peláez, and B. Osorio); Malinalco, Mexico, August 8, 1943 (C. Bolívar).

Metopilio diazi, new species

Figure 7

Male: Total length of body, 3.3 mm. Cephalothorax, 1.1 mm. Width of body at widest portion, 2.3 mm.

	I	II	III	IV
Trochanter	0.4 mm.	0.5 mm.	0 4 mm.	0.4 mm.
Femur	2.6	4.1	1.8	3 1
Patella	0.6	1.0	0.6	0.7
Tibia	1.5	3.7	1.5	2 0
Metatarsus	1.5	2.0	1.8	2 6
Tarsus	2.1	6.0	2.7	4 1
Total	8.7 mm.	17.3 mm.	8.8 mm.	12 9 mm.

Dorsum roughly granulate. Eye tubercle toward the anterior portion of the cephalothorax, low and rounded, not canaliculate. Three or four small spinules irregularly arranged on the dorsomedian portion. Anterior median elevation of cephalothorax with four to six small spines, median line of elevation unarmed. A transverse row of five to six very small tubercles posterior to the eye. This row in the median third of the cephalothorax. Last segment of cephalothorax with a transverse row of tubercles extending completely across. Large, sharp, paired spines in the median portion of the first five abdominal segments. Median portion of following two segments with smaller median paired spines. Median spines pointing upward, not curved. Laterad to the median spines is a transverse row of several small tubercles which are enlarged into spinules in the posterior segments. Venter smooth except for a few small hairs. Coxae with scattered spine-like hairs, without lateral teeth. A few larger spines at the distal portion, visible from above.

Legs: basal segments of first and third legs somewhat enlarged over the second and fourth. First leg more crassate than the third. Trochanters, femora, patellae, and tibiae with small spines which are more or less arranged in rows. Metatarsi and tarsi armed only with hairs. Distal portion of these segments with a few larger spines. Second tibia with three false articulations; fourth metatarsus with one false articulation.

Palpus: trochanter, 0.3 mm. long; femur, 0.4; patella, 0.3; tibia, 0.4; and tarsus, 0.6. Total length, 2.0 mm. Palpus thickly armed with spine-like hairs. Femur with a ventral row of spinules. Patella without apophyses. Tarsal claw untoothed.

Chelicera normal, with scattered hairs.

Dorsum brownish. Eye tubercle dark, with a median light stripe. Dark brown mottlings irregularly outlining the margin of the cephalothorax, forming another line parallel to the margin. Other brown mottlings form, roughly, a triangle posterior to the eye, with the eye tubercle as the apex. Last segment of the cephalothorax with a transverse row of brown spots. Scattered light punctations over the cephalothorax. Spines of the anterior elevation light, abdominal spines light, darker brown blotches in the lateral portion of the first three abdominal segments, helping to outline a median lighter stripe which contains the spines. Fourth abdominal segment and posterior segments lighter, somewhat obliterating the median stripe. A few darker brown mottlings on the posterior segments. Venter buff with light spots across the free sternites. Coxae with dark brown mottlings, particularly at the distal portions. Trochanters light, with mottlings on the lateral portions. Legs with much darker brown mottlings. Palpus light, with a dark brown stripe at the distal portion of the femur, dorsal portion of patella, and median portion of tibia. Chelicera pale, with darker spines.

FEMALE: Total length of body, 4.1 mm. Cephalothorax, 1.1 mm. Width of body at widest portion, 2.4 mm.

Similar to male, but with median spines much reduced; they are not much larger than the lateral ones.

TYPE LOCALITY: Male holotype and paratypes from Urúapan, Michoacan, in a garden, under stones, April 24, 1943 (M. Cárdenas and M. Correa).

This species is related to *M. multispinulatus* Goodnight and Goodnight, differing by having no spines over the eyes and by having the lateral spines smaller on the dorsum.

Some males have smaller spines and are much darker, making the median stripe more distinct.

Metopilio hispidus Roewer

Metopilio hispidus ROEWER, 1915, Arch. Naturgesch., vol. 81, sect. A, no. 3, p. 134; ROEWER, 1923, Die Weberknechte der Erde, p. 860; GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, no. 1211, p. 11, fig. 32.

RECORD: El Cedral, Mexico, November 7, 1943 (M. Cárdenas).

Metopilio maculatipes (Cambridge)

Phalangium maculatipes CAMBRIDGE, 1904, Biologia Centrali-Americana, Arachnida, vol. 2, p. 581, pl. 54, fig. 15, 15a.

Metopilio maculatipes ROEWER, 1923, Die Weberknechte der Erde, p. 860.

RECORDS: Paso de Cortes, Pueblo (C. Bolívar); National Park, Hidalgo, D. F. (C. Bolívar).

Gagrellinae Thorell

Krusa annulata, new species

Figure 17

MALE: Total length of body, 3.2 mm. Cephalothorax, 1.4 mm. Width of body at widest portion, 2.2 mm. Length of femora: I, 10.6 mm.; II, 17.3 mm.; III, 10.4 mm.; IV, 13.6 mm.

Dorsum roughly granulate, eye tubercle at the posterior portion of the cephalothorax, canaliculate, a row of small tubercles over each carina. Supracheliceral lamella extended into a sharp point. General shape of cephalothorax triangular. Venter and coxae roughly granulate. Lateral rows of three-pronged teeth present on the anterior and posterior margins of all coxae.

Legs long, clothed throughout with hairs. Numerous small dark spines on the femora and trochanters, a few smaller ones on the patellae. Metatarsi with false articulations. Nodules: 0-1-0-0.

Palpus: trochanter, 0.3 mm. long; femur, 0.7; patella, 0.4; tibia, 0.6; and tarsus, 1.0. Total length, 3.0 mm. Palpus clothed throughout with hairs; in addition it is armed with numerous small dark spines on all segments except the tarsus. Spines larger on the ventral portion of the femur, but more numerous on the patella and tibia. Anterior median apophysis of patella reduced to a very small (0.1 mm.) projection.

Chelicera normal.

Penis straight shafted.

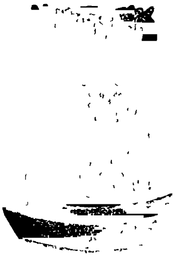
Eye tubercle dark brown, yellowish at base. A brown triangular marking encloses the eye tubercle and has its apex at the anterior margin of the cephalothorax. Lateral portion of cephalothorax silvery, with brown splotches at the posterior-lateral portion. Silvery portion with a few irregular dull spots. A few brown markings on the last segment of the cephalothorax. Abdomen light brown with darker brown markings along the lateral margin. Dark brown irregular stripe at the posterior margin of the scute and on the first free tergite. A dark brown splotch in the median portion of the remaining free tergites. Venter and coxae yellowish with only a few darker mottlings in the region of the anal operculum. Trochanters with lateral surfaces concolorous with the coxae, but with the remaining portions dark brown. Bases of femora dark brown, remainder of legs lighter brown with a white stripe at the distal portion of the femora, the distal portion of the tibia, and the proximal portion of the metatarsus; the distal portion of the metatarsus and the proximal portion of the tarsus. These white stripes are quite conspicuous. Palpus yellowish with darker brown markings on the distal portion of the femur and the dorsal portion of the patella. Chelicera yellowish.

FEMALE: Total length of body, 3.8 mm. Cephalothorax, 1.5 mm. Width of body at widest portion, 2.4 mm.

Female identical with male.

TYPE LOCALITY: Male holotype and female paratype from Acapulco, Guerrero, August 20, 1943 (D. Peláez, M. Correa).

This species differs from *K. mexicana* Goodnight and Goodnight by having a distinctive dorsal color pattern.



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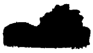

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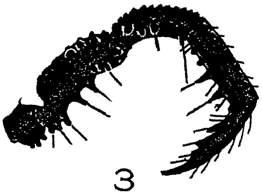

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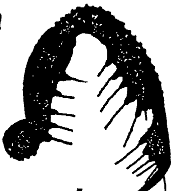

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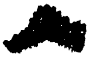

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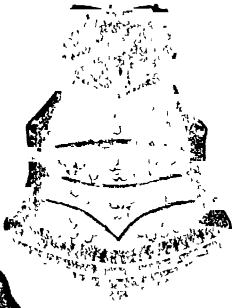

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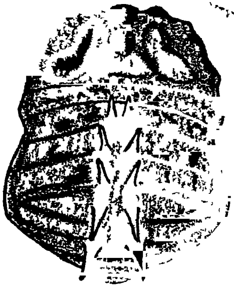

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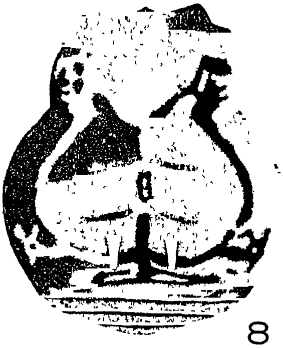

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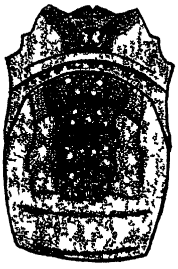

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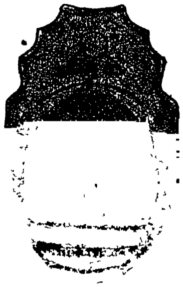

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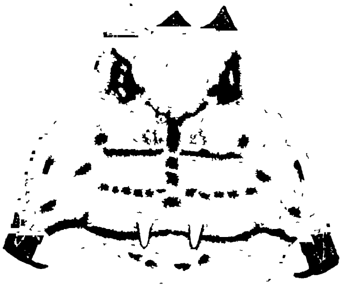

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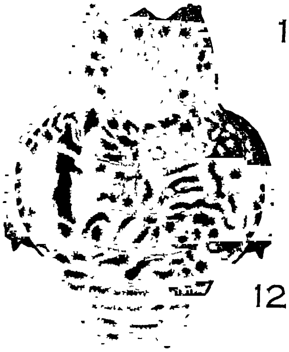

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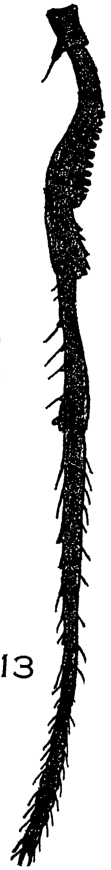

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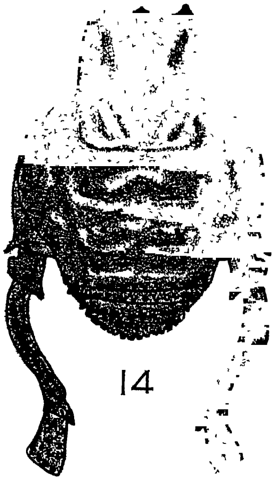
Fig. 1. *Guerrobunus minutus*, new species, dorsal view of female.
Fig. 2. Idem, lateral view of eye tubercle of female
Fig. 3. Idem, retrolateral view of palpus of female.
Fig. 4. *Montabunus foliorum*, new species, retrolateral view of palpus of male.
Fig. 5. Idem, lateral view of eye tubercle of male.
Fig. 6. Idem, dorsal view of male.
Fig. 7. *Metopilio diazi*, new species, dorsal view of male.
Fig. 8. *Cynorta fortina*, new species, dorsal view of male.
Fig. 9. *Leiobunum tascum*, new species, dorsal view of female.
Fig. 10. *Leiobunum colimae*, new species, dorsal view of male.
Fig. 11. *Cynorta cardenasi*, new species, dorsal view of male.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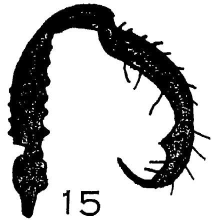
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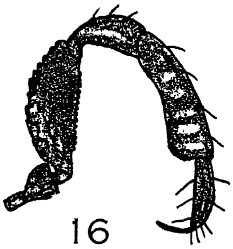
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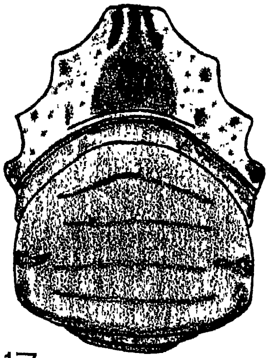
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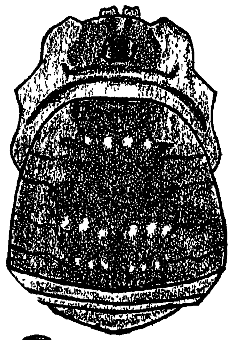
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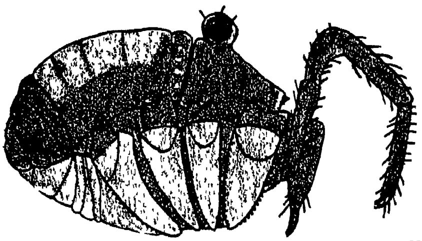
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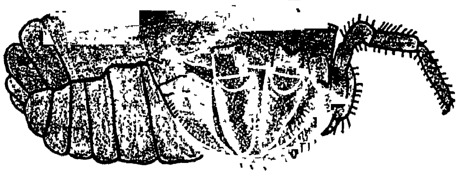
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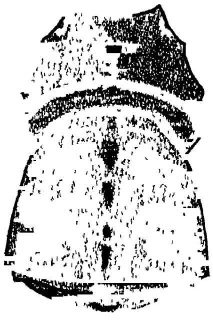
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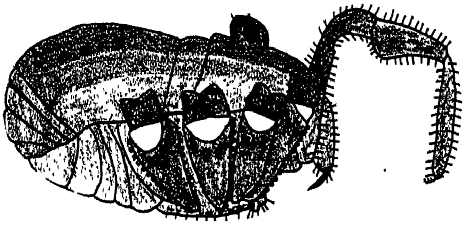
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Fig. 14. *Prosontes phalattes*, new species, dorsal view of male.
Fig. 15. Idem, lateral view of palpus of male.
Fig. 16. Idem, lateral view of palpus of female.
Fig. 17. *Krusa annulata*, new species, dorsal view of male.
Fig. 18. *Leiobunum bolivari*, new species, lateral view of male.
Fig. 19. *Leiobunum alvarezi*, new species, dorsal view of male.
Fig. 20. *Paranelima correa*, new species, lateral view of male.
Fig. 21. *Leiobunum bruchi* Mello-Leitao, dorsal view of male.
Fig. 22. *Leiobunum nigrigenum*, new species, lateral view of male.

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ON SOME DIPLOPODS FROM THE INDO-AUSTRALIAN ARCHIPELAGO

BY RALPH V. CHAMBERLIN

The millipeds upon which the present paper is based are, for the most part, embraced in a collection sent to the writer some years ago by Dr. K. W. Dammerman, then of the Buitenzorg Museum in Java. The material was collected by Dr. Dammerman and associates, chiefly in Java, New Guinea, and Sumatra and some of the smaller adjacent islands. All the material here reported upon is now in the custody of the American Museum of Natural History, except that representing *Dinematocricus hadleyi* which is in the United States National Museum.

Sphaerotheridae

Sphaeropoeus lamprongsis, new species

Figures 1–3

The integument of head and tergites brown to chestnut, darkened over caudal border. Legs brown.

Antennae very short; sixth article abruptly much thicker than the others, elliptic in cross section, the distal surface bearing numerous sensory cones.

Head strongly punctorugose, clothed throughout with numerous erect setae which are denser over the clypeal region than above.

Collum also densely rugose punctate; anterior margin arcuate, the posterior evenly convex so that lateral ends are rather narrow and acute, curving somewhat forward at ends. Subdensely setose.

Second tergite (shield) extending well below level of third and fourth, the ends broadly rounded. Anterior border and lateral ends thin, depressed conspicuously below level of remaining area of shield, the depressed border extending up on caudal side, strongly margined; anterior border of elevated portion of plate on each side of middle limited by a smooth sharp ridge. Depressed border smooth, the plate otherwise roughened and punctate as are all the following tergites, all of which are similarly setose with numerous short, erect setae.

Anterior depressed borders of succeeding tergites, which are overlapped when the animal is rolled, with free margin conspicuously elevated, the surface punctate and clothed with prone hairs.

Vulva of female as shown in figure 1.

The structure of anterior and posterior gonopods is best shown by the figures (figs. 2, 3).

Length, 25–29 mm.; width, 14–16 mm.

LOCALITY: Sumatra: Lamprongs, Wai Lima. Three females and two males taken by Karny and Siebers, November–December, 1921.

Zephronia moderata, new species

Figures 4, 5

Head dusky brown, in considerable part nearly black with the antennae fulvous. First tergite and second tergite (shield) also similarly dark colored, the latter bordered both in front and behind with yellow. In the succeeding tergites the caudal border is yellow.

The antennae very short with the distal portion thicker; first five articles very short; the sixth very large, subglobular, its distal flat surface, bearing the numerous cones, circular in outline.

Collum with caudal margin evenly convex, the anterior angularly produced at middle and concave on each side.

Second tergite (shield) extending much below level of third and fourth, with lower ends evenly convexly rounded; border relatively depressed below level of median portion as usual, margined, the general surface of the plate not roughened, setose with short erect hairs. Third tergite with lower ends narrowly acute, fourth extending considerably below it. All tergites clothed with numerous very short, erect hairs, with the surface itself smooth.

The form of tarsus and the relation of apical spine and claw are as shown in figure 4.

Anterior and posterior gonopods with tibia and tarsus fused (see fig. 5).

Length, about 16 mm.; width, 8 mm.

LOCALITY: Java: Tjibodas. One male taken in May, 1922, at 1400 meters elevation.

Zephronia tivia, new species

Figures 6, 7

Of smaller size than the preceding species and characterized especially by the form of the gonopods, which are figured.

Color brown, without special markings.

Antennae with proportions of joints as shown in the figure.

Collum with anterior margin arcuate as usual, the median portion strongly bent forward beyond level of lateral ends as figured. Crossed by two transverse lines which are bowed apart more widely from each other in middle region.

Anterior border of shield slightly angled on each side at level of eye.

Gonopods of male as shown in figures 6 and 7.

Width of male holotype, 6.6 mm.

LOCALITY: Sumatra: Lamprongs, Wai Lima. November–December, 1921, Karny and Siebers.

Tonkinobelum sumatrense, new species

Figures 8, 9

Head, collum, and anterior tergites blackish olive chestnut, the succeeding ones somewhat lighter olive chestnut, posterior margins of tergites bordered with a lighter, somewhat olive color, this lighter band sometimes broken with dark spots. Under surface of keels and pleurites, sternites, and legs also of olive cast. No spotting such as described for *T. maculatum.*

Antennae with sixth article several times longer than the fifth; the distal surface oblique and very long, extending well proximad of middle and bearing numerous sensory cones. Clypeal region of head densely punctate, the punctae fewer dorsad and very sparse over vertex.

Collum with very few, weak punctae; anterior border margined with a line-like impression. Second tergite or thoracic shield in general as in *T. maculatum,* the generotype, but the transverse furrow much shallower mesially, more distinct on each side; hirsute over anterior face and in this transverse depression.

Anterior oblique surface of succeeding ordinary tergites, overlapped when animal is rolled, with anterior margin elevated as a rim, the surface hirsute but not ridged.

Telopodites of both pairs of gonopods four-jointed, the tarsus being distinctly set off from the tibia. Prefemur of anterior pair compressed in anteroposterior direction, in anterior view subquadrate in outline, anterior corners rounded, without processes; femur with process on ectocaudal side, smooth, subacutely pointed; tibia opposite process of femur with hook-like process as antagonist; tarsus about three-fifths the width of tibia, cylindrical, distally rounded. Process of femur of posterior gonopod on mesial side, large, compressed, narrowing distally to an acute point, a blade-like expansion on ectal side from middle to base closing against a corresponding low triangular blade on mesial side of tibia; tarsus small, cylindrical, distally rounded, much narrower than tibia. (See figs. 8 and 9.)

Length, 51.5 mm.; width, at middle, 28.5 mm.; width of second tergite or thoracic shield, 27 mm.

LOCALITY: Sumatra: Manindjou. Two males taken by Leeuwen, January, 1920.

Polydesmidae

Opisthoporodesmus silvestri, new species

Figures 10–12

Reddish brown, with margins and tip of keels yellowish. Antennae and legs yellow.

Collum semilunate in outline, the anterior side and lateral ends together forming a semicircular line, and the caudal margin mesially straight and bent forward at ends. Tubercle of posterior row large but low, others obsolete, but all setae well developed.

Tergites in general with tubercles and setae as in the generotype, *O. obtectus* Silvestri. The keels raised conspicuously dorsad toward margins, with the processes more strongly produced caudad than in *obtectus*, as shown in figure 10. Posterior processes of keels of penult tergite more acute than in *obtectus* and not bilobate.

Last tergite acutely triangular in outline, relatively smaller than in *obtectus* (see fig. 10).

Tarsi of legs long and very slender.

Vulva of female a conspicuous subelliptic structure as shown in figures 11 and 12.

Length, about 13 mm.; width, 2.75 mm.; thus a much larger form than the generotype.

LOCALITY: New Guinea: Pionierbivak. One female taken June–August, 1920, by Van Heurn.

Opisthoporodesmus conservandus, new species

Figures 13, 14

General color of body brown, with legs yellow.

Keels set high and rising above level of dorsum, with posterior processes also higher than anterior part of keel. Anterior margin of keel convex, the caudal margin concave or somewhat angularly excavated, the posterior processes mostly very acute, strongly produced caudad in posterior segments. Anterior margin of keel smooth, a little rolled upward; the lateral margin with two or three small serrations. Pores opening on process at, or just proximad of, tip. (See figs. 13 and 14.)

Anal tergite triangular, the narrowed tip extending beyond the anal valves.

Gonopods of male as described under the genus.

Length of male holotype, about 10 mm.; width, 1 mm.

LOCALITY: North New Guinea: Prauwenbivak. One male taken by W. C. Van Heurn, September, 1920.

Opisthoporodesmus anandrus, new species

Head, collum, and keels above fulvous, the keels with finely meshed reticulations of dark color; the region between keels darker, of dusty or purplish cast, especially behind the suture. Sternites and legs yellow.

Collum semicircular. Anterior and posterior rows of tubercles smallest.

Second tergite with posterior corners slightly acute, the excavation on caudal margins very obtusely angular; lateral margin with two small serrations. Keels of third and fourth segments similar, but posterior angles more strongly produced and more acute. Area of keels smooth except for two pointed tubercles on ridge-like swelling running from inner anterior base to posterior process, one tooth between middle and outer end and one near caudal end of the swelling. Anterior margin smooth, bent upward. The dorsum of these three segments bearing the usual three transverse rows of tubercles, two behind the furrow. Of the two posterior rows, the anterior much the larger. Tubercles of anterior row also much smaller. Typically four tubercles in each of the first two rows and six in the posterior row.

The sculpturing of the succeeding tergites similar but the tubercles of anterior row becoming more weakly defined or essentially obliterated except the median or apical granule on each which in life was probably setigerous, the type at present being much rubbed. The repugnatorial pore close to apex of posterior process on its outer side; a tooth-like serration cephalad of the pore opening so that porigerous keels appear to bear three serrations on lateral margin.

Caudal tergite triangular, much narrowing caudad, the narrow terminal process extending well beyond anal valves, apically rounded and bearing setigerous tubercles on caudal face; four setigerous tubercles near base above and a tubercle on lateral margin proximad of apex.

Anal scale with the two caudal setigerous tubercles widely separated, the caudal margin between them straight or very slightly convex.

Length, 17 mm.; width, 2.5 mm.

Locality: New Guinea: Doormanpad. Female holotype collected October 27–30, 1920, by W. C. Van Heurn at 1800–2400 meters elevation.

The female is described without the male only because of the importance of the record and the belief that the type presents features distinctive enough for subsequent recognition.

Opisthoporodesmus simplex, new species

In the absence of a male, this species is referred to *Opisthoporodesmus* with which it agrees fully in general morphological features. It is a larger form than the generotype, *O. obtectus* of New Guinea, the length being 12 mm. as against 7 mm. and the width 1.75 mm. as against 1 mm. The details of the carinal process are also distinctive. The anterior keels continue the slope of the middorsal region, and the more posterior ones are but little more elevated. A large swelling within the lateral margin of keel and another one at base of keel. The setiferous swelling over dorsum low, not sharply set off and in part obsolete.

Dorsum brown, with legs yellow.

Locality: Java: Tjibodas. August, 1921, one female, and May, 1922, one adult female and several partly grown, at 1400 meters elevation.

Opisotretus euthus, new species

Figures 15, 16

In general structure agreeing with the larger *O. kraepelini.* Keels similar, but the tooth mesad of the pore characteristically smaller, located more cephalad, and the angle as a whole obviously more produced caudad (fig. 15). A large swelling within the lateral margination and a second one on base of keel mesad of the first. An irregular series of slight, nearly obsolete longitudinal swellings behind sulcus and one in front of it.

In the gonopods the telopodite runs outward and curves partly about the base of the ninth legs as in *kraepelini.* The tarsal division similar to that in the latter species, but differing in bearing on the outer side a characteristic process or tooth. (See fig. 16.)

Length of female allotype, about 8 mm.; width, 1.25 mm.

Locality: Java: Tjibodas. Several males and females taken by Dammerman, August, 1921, at 1400 meters elevation.

Opisotretus mimus, new species

Figure 17

Close in general structural features to *O. kraepelini.* It is separated chiefly because of the notable reduction of the keels on the last few segments, those of the eighteenth segment being obsolete and those of two preceding segments very narrow and with the caudal teeth or processes, between which the pore opens, short, not extending caudad beyond the caudal margin. These teeth are proportionately shorter and broader than indicated in Attems' drawing for *kraepelini.*

Collum somewhat broader and laterally less rounded than in *kraepelini.*

Anal segment with cauda moderately long and curved downward.

A much smaller form than *kraepelini,* the length being 7 mm. as against 12 mm.

Locality: Java: Tjibodas. Four females, May, 1922, at 1400 meters elevation.

RETRODESMUS, NEW GENUS

Agreeing with *Opisotretus* and differing from *Opisthoporodesmus* in having but 19 body segments. Differing from the former in the proportionately broader collum and in lacking the three transverse rows of setiferous swellings, the seriate setae rising from an even, smooth surface. Posterior corners of keels more strongly produced. It differs notably in the position of the repugnatorial pore which, instead of lying close to the caudal margin mesad of the corner tooth as in *Opisotretus,* lies in front of the posterior process of the keel and much nearer the lateral margin than the posterior. The gonopods are similar in having the telopodite bent transversely outward but is geniculate at junction of tibial and tarsal portion, not evenly curved; the tibial portion much shorter and distally characteristically divided into short lobes and in part fringed.

GENEROTYPE: *Retrodesmus dammermani,* new species.

Retrodesmus dammermani, new species

Figures 18–20

Color pale testaceous. Antennae long, the joints between first and fifth long and slender. The fifth moderately clavately widening distad and the sixth abruptly much thicker; seventh article well developed (fig. 18).

Collum a little narrower than second tergite and than head as a whole, but much exceeding the cranium proper; anterior and lateral margins together forming an even convex curve, the caudal margin straight; at lateral ends two obscure denticles.

All succeeding tergites with posterior corners of keels produced caudad, the processes becoming longer on more posterior segments. Caudal margin of keels smooth, bearing no tooth. Lateral margins with a minute tooth at anterior corner followed usually by three small teeth, of which the middle one is commonly reduced and on some anterior segments may be absent. Position of pore as shown in figure 19. Processes of keels of eighteenth segment reduced (fig. 19). Transverse sulcus of metazonite sharply impressed.

For structure of gonopods see figure 20.

Length, about 6 mm.

LOCALITY: Java: Tjibodas. One male taken by Dammerman at 1400 meters elevation.

Cryptodesmidae

Cryptocorypha tobana, new species

Figures 21, 22

Color pale yellow.

Collum divided into 12 areas by radial lines as usual. The marginal indentation very obtuse and slight.

Keels of the following segments with three or four lateral scallops as in *leia;* relatively wide transversely, much as in *leia.*

Distinguished especially by the details of the gonopods of the male as shown in figures 21 and 22.

Length of male holotype, 5.5 mm. An obviously smaller form than *leia,* the width being but 1.2 mm. as against 2 mm.

LOCALITY: Sumatra: Lake Toba (Tobameer). One male taken in March, 1922, by Dammerman.

Cryptocorypha leia, new species

Figures 23–26

Color of preserved type appearing brownish yellow at present, but surface more or less dirty, probably a clear yellow in life.

The collum shows 12 areas marked off by distinct radial sulci, but the margin smoothly continuous, showing no such scallops as are well developed on the keels of the other body segments (fig. 23).

On the following body segments there are three lateral scallops on the non-poriferous segments, four on the poriferous. Each pore opens in the space between third and fourth scallops at a considerable distance mesad from the marginal notch (fig. 23).

Features of the caudal end as shown in figure 24.

Gonopods as represented in figures 25 and 26.

Width of male holotype, 2 mm.

LOCALITY: Java: Goenoeng Malabar. Male holotype taken in December, 1920, at 1600 meters.

ELATOSUS, NEW GENUS

A very small form like those of *Aplotes* and *Gonomastis.* In the types, the body consists of but 19 segments in the female and 17 in the male, but the latter certainly, and the former probably, lack one molt of maturity. Anal segment bent ventrad as in the two genera mentioned. Tergites simply thickened or moderately swollen on the sides, but with no true keels, except on the second segment where there is distally expanded a descending keel. Repugnatorial pores on segments V, VII, IX, X, XI, XII, XIII, and XV–XVII opening on a level with the surface or through a simple tubercle-like swelling. Dorsum of metatergites with mostly transverse series of setae; surface not tuberculate. Antennae short, clavate.

GENEROTYPE: *Elatosus pygmaeus,* new species.

Elatosus pygmaeus, new species

Figures 27–29

Color throughout light yellow, venter and legs a little paler than dorsum.

Surface of head above and in front minutely densely granular, with the granules in large part arranged or partly fused in anastomosing lines; densely setose with short setae. Antennae short, clavate.

Collum semicircular, the anterior and lateral margins forming an evenly convex curve and the caudal margin nearly straight between rounded ends; as wide, or nearly as wide, as head inclusive of "cheeks," narrower than second tergite but as wide as third; setae sparser and larger than those on head (fig. 28).

Second tergite with keel-like lateral expansion extending downward and forward so as partly to embrace the cardo on each side, the lower end strongly and evenly convex (fig. 27).

Succeeding tergites widely and evenly smaller on the sides, with the ventral portion insunk from swollen lateral portion. Surface and setae as on the collum.

Length, about 4.7 mm.

LOCALITY: Java: Tjibodas. Several females and two males apparently lacking one molt of maturity, August, 1921, at 1400 meters elevation.

In the immature male the gonopods are represented by short, pointed stumps in which the distal article is hemispherically rounded.

PORAUXUS, NEW GENUS

Agreeing with *Elatosus* in the form of the keels of the second segment and in the absence of true keels from the succeeding ones. It differs from that genus in having pores on segments V and VII to XVIII, and in having the metatergites crossed by three transverse series of definite setigerous tubercles. Antennae inserted close together, short and thick, with second and sixth articles longest and the seventh freely exposed. Anal tubercle bent down ventrad at right angles to axis of body. Gonopods of the male relatively large with telopodite freely exposed, and biramous, with one branch long and flagelliform.

GENEROTYPE: *Porauxus pangrangus*, new species.

Porauxus pangrangus, new species

Figures 30–32

The general color of body and appendages is pale, nearly white, but in the male holotype the tergites and the upper part of head are brown from adherent material. The antennae of form shown in figure 30.

Collum covering the head in dorsal view; bearing setigerous tubercles in six transverse series.

Second tergite with a keel in vertical position extending below level of collum and of venter of third segment; lower end conspicuously expanded as shown in figure 31.

Ordinary metatergites posteriorly swollen out on sides and beneath; above crossed by three rows of tubercles (fig. 31).

Anal tergite bent down caudally behind the valves, the setae of end tubercle being directed ventrad. Anal valves meeting evenly at middle line where neither raised nor reëntrant.

Gonopods of the male with the telopodites extending caudad parallel with body axis. (For structure see fig. 32.)

Length of male holotype, 4.2 mm.

LOCALITY: Java: Pangrango. An adult male and an immature female taken in August, 1921, at 2400 meters elevation.

Cryptyma javana, new species

Figures 33, 34

Tergites and head above level of antennae white but appearing black from adherent material, the head and body elsewhere yellow.

Antennae clavate, with fifth article much the largest, but sixth and seventh well developed; second article nearly as long as fifth but much more slender.

Collum with its 10 border scallops separated by deep incisions as in the Mexican *C. lobata*, the generotype, and above bearing tubercles much as in the latter form.

The keels of the following tergites decidedly wider than those of *lobata*, with the lobe of posterior border notably farther ectad; lateral border similarly bilobed, with a deep incision between the lobes (fig. 31).

Pores difficult to see, opening remote from margin toward base of posterior lobe on segments V (?), VII, IX, X, XII, XIII, and XV–XIX.

Anal segment small, curved downward, its setae directed ventrad.

Gonopods of male with coxae very large, concave on mesial side, concealing the telopodite in side view. (For structure see fig. 34.)

Width of male paratype, 1.2 mm.; length, 4.8 mm.

LOCALITY: Java: Pangrango. One male taken by Dammerman in May, 1922, and two males and two females taken at the same place in August, 1921, at 2400 meters elevation.

Cryptodesmus weberi Pocock

Cryptodesmus weberi POCOCK, *in* Weber, 1894, Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien, vol. 3, p. 374, pl. 22, fig. 13, 13c.

LOCALITIES: Java: Tjibodas. Several not fully grown specimens probably this species collected by Dammerman, August, 1921, 1400 meters elevation.

Poentjak. Two females (one incomplete), taken January 5, 1920.

APHLOTES, NEW GENUS

Like the Sumatran *Gonomastis* in having but 19 body segments, in its very small size, and in having the nineteenth tergite bent strongly ventrad. It differs, however, conspicuously in having distinctly developed keels and in having repugnatorial pores on segments V, VII, IX, X, XII, XIII, and XV–XVII instead of on segments V, and VII to XVII. Pores opening at end of tubercles which run a little in front of the characteristic notch at caudolateral corner of keels, the latter being otherwise entire. Antennae short, subclavate, proportionately thick, with fourth, fifth, and sixth joints differing not much in width but the sixth over twice the length of the short fifth; seventh article freely exposed, antennae inserted close together and each lying in a groove running obliquely caudolateral from its base.

For features of gonopods see figures 37 and 38.

GENEROTYPE: *Aphlotes litus*, new species.

Aphlotes litus, new species

Figures 35–38

This, one of the smallest of known polydesmoids, is pale yellow in color.

Head densely covered above and in front with small uniform setiferous granules. All joints of antennae, except the sixth, unusually short and proportionately thick.

Collum wider than the head, narrowing toward each end which is rounded below, the ends extending part way down over "cheeks." Collum not covering the head in dorsal view. Its surface densely granular and setose, the succeeding tergites being similarly clothed.

Keels of second tergite bent down vertically or nearly so, prolonged much below level of ends of collum; the end portion with margin strongly rounded, set off by a longitudinal furrow; keels as a whole set off by a longitudinal furrow at base; notched on posterior side for reception of succeeding keel when the animal is rolled up. (See fig. 35.)

The keels of third and fourth tergites descending less toward the vertical position and less prolonged. On the succeeding tergites the keels are longer in anterocaudal direction with the lateral end lobe not set off and the lateral margin long and more moderately convex. On all keels a furrow runs cephalad from the notch and separates two smaller areas. The keels become narrower and rise more toward the horizontal in going toward caudal end. (See fig. 35.)

The gonopods of the male are proportionately large and well exposed. Coxae separated, large, hemispherical, concealing the proximal portion of telopodite in lateral view. Telopodite arising near caudal end of coxae on mesial side and running forward; having a distally truncate laminate lobe from vertical side near middle, the blade cephalad of this more slender and of form shown in figures 37 and 38.

Length, about 4 mm.

Locality: Java: Tjibodas. A male and female taken by Dammerman, August, 1921, at 1400 meters elevation.

Aphlotes auctus, new species

Figures 39, 40

The body in general is pale yellow or nearly white; often appearing rust colored, mostly in patches, from material adherent to the dense setae.

Structure in general close to that described and illustrated for *A. litus*, differing in the details of the gonopods of the male as shown in figures 39 and 40.

An obviously larger form than *A. litus*, length typically 6 mm. as against 4 mm. and less.

Locality: Java: Pangrango. Ten specimens taken by Dammerman in August, 1922, at 2400 meters elevation.

Oniscodesmidae

HOPLITESMUS, NEW GENUS

Closely resembling *Doratodesmus*, but the body composed of only 19 segments instead of 20 and the middorsal processes beginning on the fourth segment instead of the fifth. Sternites reduced as in *Doratodesmus* so that coxae are nearly contiguous except in sixth segment where well developed, with coxae widely separated, and on fifth where of intermediate width. Legs of seventh segment in male also inserted widely apart.

Generotype: *Hoplitesmus enoplus*, new species.

Hoplitesmus enoplus, new species

Figures 41–44

Dorsum between keels appearing black, or nearly so, to the naked eye, the anterior median processes similar, but the longer posterior ones distally brownish yellow. Keels brownish yellow and the legs light yellow. Dark color apparently due largely to adherent material which rubs off more readily on prominences.

Antennae short, but proportionately not so thick or clavate as in *Doratodesmus armatus*.

Collum as wide as head, but not concealing the latter fully in dorsal view; surface marked off into flat tubercular areas; with a median longitudinal depression.

Second tergite with keels very large, descending below the horizontal and partly concealing the head in lateral view; between keels covered with flat tubercles arranged in three transverse rows which are widely interrupted at middle, the tubercles not developed on the keels; tubercles normally bearing short setae but these mostly rubbed off in the type specimen. The general form and relations are shown in figure 41.

Third tergite with keels smaller, narrowed acutely distad as shown in the figure. Most mesial tubercle of second and third series on each side enlarged, that of the third the more so, and basally confluent but well separated from those of opposite side. On the fourth tergite the corresponding tubercles more enlarged and salient and contiguous at base with those of opposite side. On subsequent tergites the composite processes increasing in size to the seventeenth on which the process is largest and projects above that of the eighteenth tergite, as shown in figure 42 which also indicates the form of the posterior keels.

Gonopods of male as shown in figures 43 and 44.

Width of male holotype, 5 mm.; length, about 25 mm.

Locality: Poentjak. One female, May 7, 1920.

PAUROPLUS, NEW GENUS

In general features resembling *Hoplitesmus* but bearing a developed middorsal process only on the antepenult segment, with weaker ones on the two preceding segments and none on the others. Keels strongly bent downward, ectad of bases.

For structure of gonopods of male see figure 47.

Generotype: *Pauroplus analdes*, new species.

Pauroplus analdes, new species

Figures 45–47

The types light yellow in color.

Antennae short, strongly clavate, with the fifth and sixth joints especially thick.

Collum as wide as the head but leaving the latter largely exposed in dorsal view; anterior margin less convex than the posterior, the two meeting at an angle on each side; dorsal surface occupied by four transverse rows of even tubercles.

Second tergite with keels broadly expanded on anterior side bending convexly forward but only partly concealing the head in lateral view; of form shown in figure 45, beyond base each keel extending downward, subvertical in position; dorsal surface with three transverse rows of tubercles on each side, the end of these rows of the two sides widely separated in middorsal region.

On the subsequent tergites the keels are also much depressed ectad of bases but less than those of second tergite; general form and relations as shown in figure 45; thick transverse rows of setigerous tubercles, of which only two rows may be well marked; the most mesial tubercle of the caudal row on each side a little enlarged, but the enlarged tubercles of the two sides not meeting in the middle to form processes except on the antepenult segment, where the process is large and projects caudodorsad, and on the two preceding segments in which the processes are low. For these and other features of posterior segments, see figure 46.

Gonopods of male represented in figure 47.

Width, 9 mm.

LOCALITY: Sumatra: Lompongs, Pedada Bay. Male holotype and female allotype, January, 1922.

Strongylosomidae

OXIDUS COOK

Oxidus COOK, 1911, Proc. U. S. Natl. Mus., vol. 40, p. 628.

Kalorthomorpha ATTEMS, as subgenus of *Orthomorpha*, 1914, Arch. Naturgesch., vol. 80, pp. 191, 195; 1936, Das Tierreich, no. 68, p. 80.

It seems to the author best to recognize the two subgenera of *Orthomorpha* defined by Attems as genera. As *Oxidus* Cook antedates *Kalorthomorpha* Attems and has the same species, *gracilis*, as its type, obviously Cook's name must be used.

Oxidus sequens, new species

Figures 48, 49

The type is a pale brown form belonging in the *filarius* group.

Body slender, moniliform, each segment being deeply constricted between prozonite and metazonite. Metatergite with the usual transverse sulcus. Keels absent, represented merely by striae.

Fourth sternite of male with a process in form of a transversely placed, distally truncate lamina.

Gonopods of male holotype, 13 mm.

LOCALITY: Java: Pangrango. August, 1921, at 2400 meters elevation.

Oxidus lamellifer, new species

Figure 50

Color pale chestnut, often showing cross bands of a more yellow tint.

Segmental constriction and metazonal transverse sulci developed in average degree and metazonite with the usual transverse series of setae. Keels narrow but distinct throughout; caudal processes of keels in posterior region slenderly acute.

Fifth sternite of male with a long, narrowly lamellar process which curves forward toward free end and bears on anterior surface numerous curved setae. Second and third legs in the male thickened, the fourth article in particular bulging convexly on outer side. Inner face of articles of these legs, except last three, bearing numerous long setae which are distally curved or curled.

Distinct in the form of the gonopods (fig. 50).

Width of male holotype, 1.6 mm.; length, about 16 mm.

LOCALITY: Java: Tjibodas. Males and females taken by Dammerman in August, 1921, at 1400 meters elevation.

Oxidus filarius (Attems)

Figure 51

Orthomorpha filaria ATTEMS, 1932, Treubia, vol. 14, p. 38, figs. 19–20.

LOCALITIES: Java: Tjibodas (type locality). Several males and females taken by Dammerman in August, 1921, at 1400 meters elevation; many in October, 1906, collector not given.

Pangrango. Several males taken likewise in August, 1921, at 200 meters elevation.

Oxidus pygmaeus (Pocock)

Figure 52

Orthomorpha pygmaeum Pocock, *in* Weber, 1894, Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien, vol. 3, p. 360.

The color of the specimen is yellowish throughout, the legs clearer yellow than the body.

A small form which is more robust, with segments more compactly arranged than, for example, in *ariies*. Metazonites with transverse sulcus well marked and distinct, with posterior angles produced in some degree caudad, beginning with those of fifth segment, the posterior corner of those of fourth angular but not produced.

Fifth sternite of male with a single process which is low.

Telopodite of male gonopod characteristically complicated, as shown in figure 52.

Width, 1.25 mm.

Localities: Java: Tjibodas. One male taken by Dammerman in August, 1921, at 1400 meters elevation.

Pangrango. Several males and females taken by Dammerman, also in August, 1921, at 2000 meters elevation.

Oxidus hydrobiologicus (Attems)

Orthomorpha hydrobiologica Attems, 1927, Zool. Meded. R. Mus. Nat. Hist. Leiden, vol. 10, p. 120, figs. 1–4.

Localities: Java: Pangrango. Several males and females, August, 1921, elevation 3000 meters.

Krakatau. Several specimens, December, 1919.

Karimon Djawa Island. Several taken by Selsman in October, 1920.

Oxidus annex, new species

Figures 53, 54

Body light brown, anteriorly of chestnut cast. Some specimens have the segment behind the metazonal sulcus with adjacent part of following prozonite lighter in color, giving the appearance of alternating dark to light anals. Legs yellowish.

Segments deeply constricted, and the metazonites with dorsal sulcus distinctly developed. Two transverse series of rather long stout setae across edge. Keels narrow but distinct, with posterior corners acutely produced on segments behind the fourth; posterior corners of keels on second and third segments rounded. Pleural keels absent or abortive.

Fifth sternite of male with a single large process which is tongue-like and broader distally than proximally.

The gonopods are as shown in figures 53 and 54.

Length of male holotype, about 18 mm.; width, 2 mm.

Locality: Java: Tjibodas. Several specimens of both sexes taken by Dammerman, August, 1921, at 1400 meters elevation. He also took a male at the same place in May, 1922.

Oxidus malabarus, new species

Figure 55

Dorsum in types pale brown with lower part of sides and legs yellow.

Tergites with the transverse sulcus sharply developed; with the usual transverse series of moderately coarse setae which project dorsocaudad and seem especially conspicuous on the posterior segments. Keels very narrow on anterior segments; also narrow on posterior segments, but better developed, with caudal angles free and acutely produced.

In the male the sternite of the fifth segment with a single process which is long and slenderly tongue-like.

Gonopods as shown in figure 55.

Width of male holotype, about 1.6 mm.

Locality: Java: Goenoeng Malabar. Male holotype and several broken females, December, 1920, at 1600 meters elevation.

Oxidus pangrangus, new species

Figure 56

Dorsum brown or somewhat chestnut without lighter longitudinal band but with keels yellow.

Tergites with the usual deep transverse sulcus; keels narrow but with posterior corners sharply produced on posterior segments, the processes in anterior region reduced; dorsal setae present, moderately long and coarse, arranged in four definite transverse series, two in front of sulcus and two behind it.

Pleural keels obsolete.

Sternite of fifth segment with a low but broad setigerous prominence but none on fourth sternite.

Gonopods of male as shown in figure 56.

Width, 2 mm.

LOCALITY: Java: Pangrango. Male and female taken by Dammerman in May, 1922, at 3000 meters elevation.

Orthomorpha consocius, new species

Figure 57

Close to *O. spinalum* Attems, described from Karimon Djawa Island, with which it agrees in the male gonopods in having a spine on the inner side of the telopodite near the distal end; but this spine is conspicuously shorter and subconical in form, while the excision at the end of the telopodite in *spinalum,* with tooth at its bottom, is quite absent in the present form, as shown in figure 57.

It is apparently a smaller form than *O. spinalum,* the width of the male holotype being 3.2 mm. as against 4 mm.

LOCALITY: Java: Tjibodas. Male holotype taken by Dammerman, July, 1920.

Orthomorpha eupistum, new species

Figures 58, 59

Dorsum dark brown or obscure chocolate, body paler beneath. Antennae brown. Legs yellow, in some darker distally. Head paler, yellowish on lower sides and in clypeal region.

Sulcus across vertex of head deep. Head smooth, setae as usual.

Collum rounded and margined about lower end and up and across anterior border, the margination becoming very narrow in dorsal region.

Keel of second segment thin and very narrow, merely a thin, ridge-like elevation, complete, rounded off at ends; pleural keel well developed, acutely produced behind. The keel of the third segment similar, that of the fourth segment a little thicker, both with pleural keels similar to that of second segment. Keels of fifth and subsequent pore-bearing segments similarly little raised but much thicker, with caudal end narrowed to point and the pore on lateral surface at base of this narrowed apical portion; the intervening keels thin. Pleural keel on fifth, sixth, and seventh segments well developed, but lower than more anterior ones, produced at caudal end; the pleural keels behind this fading out and soon not evident.

Anal tergite prolonged, with tubercle at each end of caudal margin long and curved downward. Process on fifth sternite large, laminate, bent ventrocephalad, distally convex.

Anal scale subtriangular in general outline, an apical portion set off by a sulcus and obtusely angular at apex.

Gonopods as illustrated.

Width of male, 2.2 mm.

LOCALITIES: New Guinea: Doormanpad. Two males taken by Van Heurn, October, 1920.

Java: Tjibodas. Several males and females taken by Dammerman, July, 1920, and two males, October, 1906, at elevation of 1400 meters.

PAPUOSOMA, NEW GENUS

Body consisting of 20 segments, with repugnatorial pores borne on the lateral surface of keels near caudal end thereof on segments V, VII, IX, X, XII, XIII, and XV–XIX.

Keels well developed but only of moderate width, those of segments II to IV especially narrow and rounded at ends. Second keel below level of third as usual. The other keels with posterior corners from rectangular to acutely produced. Keels set off by a deep furrow above, this running essentially straight forward.

Segments deeply constricted; each metatergite crossed by a sulcus which is sharply impressed except on most anterior segments. Collum and metazonites of other tergites bearing a transverse series of setae along anterior portion, the keels also each bearing two stout setae in the generotype.

Pleural keels not developed.

Only the sternite of the fifth segment in the male with a process, this in the form of a conspicuous setose lamina.

No special processes on femora or other joints of any of the legs.

Gonopods of male with femur short, rounded, densely setose, set at right angles to coxa and in line with telopodite. Terminal process arising at distal end on upper side toward outer edge; bending first caudad and then curving forward (distad) in a semicircle sheathed against the tarsal process which arises on dorsal surface distad of middle and is a lamina of nearly uniform width.

GENEROTYPE: *Papuosoma cladis*, new species.

This genus appears to be most nearly related to *Antichiropus* of Australia and *Mimosoma* of the Solomon Islands.

KEY TO SPECIES OF *Papuosoma*

a. Keels, except on anterior segments, virtually obliterated, being indicated by a longitudinal sulcus, below which the thickening is slight or absent.
  b. With a continuous median dorsal yellow stripe; keels of second segment well developed ....*zygethus*, new species
  bb. Without such longitudinal dorsal stripe; the dorsum uniformly colored or with prozonites alone paler ....*prodelum*, new species
aa. Keels distinctly developed throughout.
  b. Dorsum nearly uniformly colored, or only with prozonites lighter than metazonites, the latter not marked with cross or longitudinal bands or with median spots.
    Dorsum light brown; anal tergite with posterior margin convex; width, 3 mm. ....*obesum*, new species
  bb. Dorsum with distinct color markings.
    c. A continuous yellow stripe along dorsum..........*typonotum*, new species
    cc. Not with a continuous yellow stripe along dorsum; each ordinary segment with an inversely Y-shaped yellow mark...........*cladis*, new species

Papuosoma cladis, new species

Figure 60

Head in the holotype yellowish chestnut, the antennae similar but becoming darker distally, the seventh joint dark blackish chestnut but cone-bearing apex abruptly pale, as is also the first article. Dorsum with a deltoid chestnut area on each segment with base on caudal margin and apex at the constriction; on each side a wide chestnut band beginning dorsally in front of constriction and running obliquely over region of keel, these chestnut areas leaving between them dorsally an inversely Y-shaped yellow mark on each segment, the arms of this mark embracing the deltoid area. Legs yellow except for a dark ring toward distal end of tarsus.

Antennae long, with sixth article obviously thicker than the fifth and abruptly much thicker than the seventh.

Body much constricted behind the collum over region of second, third, and fourth segments, the fourth segment narrowest.

Collum semicircular; with a series of stout setae about anterior and lateral border. The following segments each with a series of similar setae across anterior portion of metazonite and with two stout setae on each keel. Metazonites of typical segments crossed by a sharply impressed transverse sulcus which, however, is only vaguely indicated on segments II to IV.

Keels of second, third, and fourth segments narrow, extending from caudal margin to segmental constriction, anterior and posterior ends rounded. Succeeding keels abruptly wider, wider behind than in front and with the caudal outer corner angular, the angle, at first subrectangular, becoming acutely produced in posterior segments. The repugnatorial pore on lateral margin of keel at base of caudal corner or process.

Anal tergite strongly narrowed caudad, but with the caudal end concave, presenting a tubercle-like process at each angle.

Process from sternite of fifth segment a lamina widening a little from base distad, and with the distal margin convex; setose.

Gonopods with tarsus arising from dorsal side of tibia distad of middle, of nearly uniform width to the acute distal tip, distal end recurved. Tibial process arising at distal end, curving first proximad and then into a semicircle. (See fig. 60.)

Length, about 25 mm.

LOCALITY: New Guinea: Doormanpad. Male holotype collected by W. C. Van Heurn, October 27–30, 1920, from 1800 to 2400 meters elevation.

Papuosoma prodelum, new species

Figures 61, 62

Head dilute chestnut, the antennae more brown, the sixth joint darker distally and the seventh abruptly much darker, blackish except for the yellow apical portion. Metatergites of segments also pale chestnut, the prozonites and sides and venter yellow. Legs also yellowish but lacking the dark ring present on tarsus of *cladis*.

Setae arranged on collum and metazonites as in *cladis* but fewer in number.

Keels only slightly raised above general surface, being much narrower than in the generotype, the caudal processes small and close to the surface.

Anal tergite very characteristic, being caudally deeply, subquadrately excised so as to leave on each side of excavation a long process, these processes distally acute, and curving ventrocaudad. Two setae on small tubercles at bottom of excavation. (See figures showing lateral and dorsocaudal views.)

Laminate process from sternite of fifth segment distally truncate, wider at base than at free end.

Gonopods as shown in figures 61 and 62.

Length, about 20 mm.

LOCALITY: New Guinea: Doormanpad. Male holotype and paratype and female allotype collected by W. C. Van Heurn, October 27-30, 1920, at elevation of 1800 to 2400 meters.

Papuosoma typonotum, new species

Figure 63

General coloration as in *P. prodelum*, but with a sharply defined median yellow stripe along dorsum. Clypeal region yellow. Antennae with seventh article darker as in the preceding forms. Keels, sides, venter, and legs yellow, the legs without dark tarsal rings.

Transverse series of setae as usual.

Keels better developed than in *prodelum* but less than in *cladis*.

Anal tergite with distal lamina a little widening at end, caudal margin widely, weakly incurved, the processes at ends slight.

Ventral process of fifth segment narrowed moderately distally, the distal end convex.

Gonopods as shown in the figure.

Length, about 23 mm.

LOCALITY: New Guinea: Doormanpad. Male holotype taken by W. C. Van Heurn, October 27–30, 1920, at elevation of 1800 to 2400 meters.

Papuosoma zygethus, new species

Head above chestnut with dusky markings, paler below. Antennae brown, with the two distal articles darker, the seventh being black. Dorsum chestnut at sides, with a continuous, wide, median, yellow stripe over entire length from head to anal tergite; the median band on the collum narrowed, hour-glass shape, being widest at posterior and anterior margins. Anal tergite and valves dark, somewhat dusky. Body becoming paler down sides and on venter.

Sulcus on vertex of head deeply impressed; a seta each side of its middle and one each side of anterior end, with a series of paired setae below this between antennal sockets, and the clypeal region setose as usual. Antennae with joints of moderate length, the distal joints thicker.

The collum of usual general form, narrowly margined. Setae rubbed off type, but scars indicate the presence of the two usual series.

The following segments with segmental sulcus very deep. The metazonite slightly depressed across middle but with no sharply impressed sulcus, although a pale transverse line seems to represent it on the most posterior segments.

Keels of second, third, and fourth segments narrow but distinctly developed, but the following segments bear only a deep longitudinal sulcus above the level of the pores, the keels being not developed. The sulcus very weak or obsolete on posterior segments.

Anal tergite short, narrowed strongly caudad, the process distally subtruncate or slightly incurved.

Width, 2.1 mm.

LOCALITY: New Guinea: Doormanpad. Female holotype taken by W. C. Van Heurn, October 27–30, 1920.

Papuosoma obesum, new species

Head light brown. Antennae yellow except seventh article and distal end of sixth which are chestnut. Dorsum light brown, with prozonites lighter, yellow. Sides, venter, and legs yellow.

Median sulcus in vertex impressed as usual. Vertex with sparse, short setae, the setae of clypeal region more numerous. Antennae moderately long, slender; sixth joint thicker than the fifth.

Collum strongly narrowed on each side, the ends rounded.

Keels of second segment in the usual position, narrow, caudal and produced caudad and rounded. Keels of third and fourth segments very narrow, the caudal ends slightly produced. Succeeding keels very thick, thickest at level of repugnatorial pore which is near middle of height.

Transverse sulcus across metatergite distinct except on anterior segments.

Caudal tergite convex at base, strongly narrowed caudad, with the narrowed caudal portion nearly horizontal; caudal margin truncate.

Anal scale subtriangular with distal angle rounded.

Width, 3 mm.

LOCALITY: New Guinea: Doormanpad. One female taken by W. C. Van Heurn, October 27–30, 1920.

CALOMA, NEW GENUS

In general form resembling *Papuosoma.* The first legs of the male of normal size and without processes or other special modification. Distinct in the structure of the gonopods of the male. In these the coxa is elongate and at right angles to the telopodite, the femur short, ovoid, and densely setose; toward distal end of tibia a strong and slender stylus arises on mesial side; at base of tarsal division on ventral side a prominent body which divides into two lamellae; the principal tarsal process a long lamina which is nearly straight except at distal end where bent ventrad into a subuncate form.

GENEROTYPE: *Caloma agametum,* new species.

Caloma agametum, new species

Figure 64

Head brown, darkest above. Antennae yellow, darkened distad, the fifth article blackish at distal end, but joints beyond the fifth missing from the holotype and shade of color therefore uncertain. Dorsum dark, nearly uniform, brown, entirely without lighter markings. Pleural and ventral regions paler, tending toward yellow. Legs yellow.

Sulcus on vertex of head sharply impressed, a series of few setae each side of its anterior end. Setae numerous in clypeal region.

Collum semicircular with lateral ends well rounded. A series of eight long setae along anterior border and a series of four across posterior portion. Following segments deeply constricted as usual. The metazonites crossed by a sharply impressed transverse sulcus, in front of which is the usual series of few, long setae.

Keels of second segment well below level of others. Keels of second, third, and fourth segments thin and narrow, produced at caudad end in a short, acute angle. Succeeding keels abruptly much thicker but very narrow, acutely produced at caudal end. Pore on lateral surface of keel toward lower edge at base of narrowing caudal portion.

Anal tergite with the usual two caudal processes, these moderately long and decurved.

Process of sternite of fifth segment laminate, moderately long and curved forward, narrowed distad and with distal end subtruncate.

Gonopods as shown in the figure.

Width, 1.9 mm.; length, about 20 mm.

LOCALITY: North New Guinea: Prauwenbivak. One male taken by W. C. Van Heurn, November–December, 1920.

XENOSOMA, NEW GENUS

Body consisting of 20 segments, with repugnatorial pores on segments V, VII, IX, X, XII, XIII, and XV–XIX, as usual. Pores borne on lateral surface of keels at caudal end of processes.

Keels well developed, the second carried below level of adjacent ones. Posterior corners of keels of most segments moderately produced, the processes apically rounded.

Transverse sulcus of metazonites weak.

Anal tergite moderately wide distally, rounded or subtruncate.

Sternite of fifth segment with a forwardly directed process.

Femur of first legs with an acute ventral process at proximal end.

Gonopods with femur short. Tibia with a short curved process on outer side at base, and with its principal process arising from upper surface toward inner edge some distance proximad of end and curving dorsoproximad. Tarsus arising proximad of apex of tibia at outer edge and curving forward (distad).

GENEROTYPE: *Xenosoma atyches*, new species.

Includes also a second new species, *X. sonandrum*.

Xenosoma atyches, new species

Figures 65–67

Head and antennae chestnut in color. Body with dorsum and sides also dark chestnut; collum and each metatergite with a large triangular yellow spot having apex forward. Venter yellowish. Legs brown.

Antennae short. Head smooth, vertex with sulcus long, fine and sharply impressed.

Collum sub-semicircular, the lateral ends a little extended and widely rounded.

Keels of second segment thin and long, extending forward beneath edge of collum and also produced caudad, much longer than those of third segment. Keels of second and subsequent segments rounded anteriorly and produced posteriorly. Keels of fifth segment and succeeding poriferous ones much thicker than the non-poriferous keels. Repugnatorial pore borne at base of caudal process toward ventral edge of lateral surface.

Anal tergite narrowed caudad, conspicuously produced beyond anal valves, the sides of projecting portion subparallel, bent down, the ventral side concave or fluted; caudal corners rounded, the intervening caudal margin a little concave.

Sternal process of fifth segment but a little forward, of form shown in figure 65.

Femoral process of first legs short, acute.

Gonopods as shown in figures 66 and 67.

Length, approximately 17 mm.

LOCALITY: North New Guinea: Prauwenbivak. Holotype a male, allotype a female; several additional paratypes in a broken condition. Collected by W. C. Van Heurn, September, 1920.

Xenosoma sonandrum, new species

Figure 68

Head chestnut, sometimes blackish. Antennae lighter in color, typically somewhat yellowish over basal portion of each article and chestnut or dusky distally. Dorsum chestnut, very dark when in full color, the collum and metatergite of each of the succeeding tergites with a large median yellow spot narrowing to a point cephalad; tergite without yellow marking. Pleural region also chestnut, being paler ventrad, the venter yellow. Legs chestnut, often dusky, the apical portion of tarsus yellow.

Collum of the usual semicircular shape and margined laterally and part way up anterior margin on each side.

Keels of second tergite wider, extended conspicuously farther laterad than, e.g., in *Caloma agametum*, produced caudad. Keels of third and fourth segments also thin and concave inside of elevated margin, the caudad end a little produced but distally rounded. Succeeding keels much thicker, with caudal ends less produced and distally rounded, with the pore laterally located and nearer caudal end than in the preceding species. Segments constricted as usual.

Metatergites transversely depressed at middle but without sharply impressed sulcus.

Anal tergite of usual general form, caudal portion concave beneath, the caudal end convex, with tubercles obscure.

Process of fifth sternite of the male low, distally rounded.

Ventral femoral process of first leg of male triangular in outline as viewed from behind.

Gonopods as figured.

Length of male, about 18 mm.; of female, 23 mm.

LOCALITY: North New Guinea: Prauwenbivak. Male holotype, female allotype, with two male and two female paratypes taken by Van Heurn, November–December, 1920.

Platyrhacidae

PLATYRHACUS C. KOCH

Platyrhacus C. KOCH, 1847, Kritische Revision der Insektenfaune Deutschlands von...Panzer, p. 58.

For the purposes of the present study it has seemed best to use *Platyrhacus* in the broad sense adopted by Attems, who selects the Javan *P. pfeiferae* Humbert and Saussure as a new type, and to recognize certain groups as subgenera rather than as genera as originally proposed.

Platyrhacus (Platyrhacus) acmophorus, new species

Figures 69–71

Color dark brown, in some nearly black, the ventral surface and legs a lighter brown. Keels often lighter, especially toward margins.

Median sulcus across vertex of head ending well above the level of the antennal sockets in a furrow or depression that widens out ventrad to pass into general level of region below antennae. Vertex densely granular.

Metazonites with three transverse rows of tubercles which are much smaller than in *conformatus* and are well separated from each other. Tubercles of posterior row much larger than the others, subconically elevated, those of anterior row minute. Prozonites granular as usual. Keels ectad of ends of tubercle series, and dorsal surface between major tubercles bearing numerous coarse granules which are not crowded.

Keels excised laterally between the angularly projecting corners. In lateral excavation of keels of second, third, and fourth segments one or two small teeth. Excision of fifth and succeeding keels also ordinarily with two or three small teeth, though these sometimes much reduced. The posterior corner processes becoming larger and projecting more and more caudad in approaching posterior end as usual. Pores on lateral margin. (See figs. 69 and 70.)

Anal tergite shaped as in *conformatus*. typically with seven setiferous notches, The usual two setiferous tubercles above.

Sternites without setae and without spiniform processes, at most with slight tubercular elevations mesad of the bases of legs.

Gonopods as shown in figure 71.

Width of male holotype, 10.2 mm.; of female allotype, 12 mm.

LOCALITY: New Guinea: Doormanpad. Male holotype, female allotype, and 10 paratypes taken by W. C. Van Heurn October 27–30, 1920, at 1800 to 2400 meters elevation.

Playrhtacus (Platyrhacus) doormanpadus, new species

Figures 72–75

Dorsum fuscous or black, with borders of keels and tip of anal tergite paler, light brown or yellowish. Legs light brown, the antennae dark brown.

Vertex of head strongly granular, with usual furrow and sulcus. Middle lateral region elevated in deltoid area which is much smoother, the granules fine and well separated. On upper part of deltoid are a pair of setae and lower down the usual curved series of setae.

Collum with lateral ends of keels conspicuously depressed. Anterior series of tubercles set off behind by a conspicuous transverse depression; the tubercles close. Tubercles of caudal series larger, subcontiguous. Tubercles of third row distinct but second series obscure, its tubercles lost among the large granules.

Keels of other tergites wide. Lateral margins of keels concave, the concave margin on first and second keels typically with three small teeth, the number on more posterior segments commonly from four to six. Anterior and posterior margins of keels finely dentate, the denticles well separated. (See fig. 72.)

Tubercles of caudal series across metatergites rather large, subcontiguous, low. Tubercles of first series obscure and those of second series also depressed, but little developed. Surface between tubercles with the granules weakly indicated but in large part almost obliterated, leaving the surface nearly smooth. Pores on upper surface, their diameter or more from margin.

Anal tergite characterized by having a conspicuous convex process at middle of caudal margin as figured (fig. 73).

Sternites nearly smooth, without cones at bases of legs. Anal scale with caudal tubercles low and rounded, almost obliterated; the margin between tubercles wide and straight.

Gonopods as figured (figs. 74 and 75).

Width of male holotype, 8.3 mm.; of female, 9 mm.

LOCALITY: New Guinea: Doormanpad. Male holotype and female allotype taken by W. C. Van Heurn, October, 1920.

Platyrhacus (Platyrhacus) parabates, new species

Figures 76, 77

Dorsum dark brown, the keels beyond bases fulvous. Pleural region also brown, the sternites and legs yellow.

A deep and widely flaring furrow crossing vertex of head and widening into clypeal region. Vertex densely, coarsely granular, the region below level of antennae also densely granular. Clypeal region bearing four prominent setigerous tubercles arranged in a semicircle, the concavity of which is ventrad; a larger series of setae adjacent to labrum in a wider semicircle.

Metazonites of body segments with three transverse series of tubercles, these all small and widely spaced, those of the posterior series typically about 12 in number and larger than those of the other series. Median area of keels covered with coarse, elevated tubercles, the borders with tubercles much smaller, granuliform.

Collum with anterior margin widely concave, the anterolateral margin on each side convexly rounded. Large tubercles along lateral and anterior borders, the depressed area within the elevated border formed by these tubercles densely granular and with sparse, smaller tubercles, a row of which lies along caudal border.

Dorsum of succeeding anterior segments conspicuously convex. Keels with anterior corners projecting farther laterad and the lateral margins oblique. Lateral margins wavy or crenate, there being on each mostly four major crenatures. In middle region the posterior corner becomes more extended and presents a caudally directed angle which becomes more and more produced caudad, the processes of the posterior keels broader and distally rounded as shown in the figures. Pores removed from margin mostly by a distance about equal to the diameter of the rim encircling the opening (fig. 76).

Anal tergite with caudal margin strongly convex, the middle part truncate, setigerous; lateral margins parallel.

Sternites without spiniform processes, smooth. Anal scale widely trapeziform, the margin straight between the setigerous tubercles, the lateral margins widely flaring.

The gonopods with coxae mostly concealed as in *simplicior,* the anterior face bearing only two setae. Femur-tibia densely setose on all sides over whole length. The smooth telopodite divided distally, the two prongs arising at the same level, acutely tapering, recurved (fig. 77).

Width, 9 mm.

LOCALITY: Sumatra: Lamprongs, Wai Lima. Male holotype and many paratypes, now mostly much broken, taken by Karny and Siebers, November–December, 1921.

Platyrhacus (Platyrhacus) relaxus, new species

Figures 78, 79

Dorsum fuscous, the keels yellow, anal tergite with border of yellow. Antennae and legs brown.

Labral region abruptly depressed below clypeus, bearing above the setigerous edge a curved transverse series of seven setae. The usual series above them on lower part of clypeus.

Collum as shown in figure, the lateral ends depressed. The usual four series of tubercles, the anterior row ordinarily embracing 10 tubercles, the posterior site, and the two intermediate four each.

Metazonites with tubercles of the three transverse series small, much as in *uncatalus* but those of two first rows relatively smaller; tubercles on second and third segments larger than those of following segments. Keels wide, lateral marginal thickenings giving a crenate appearance, the crenations mostly small and from four to seven in number, rather irregular. Pore on upper surface, and, inclusive of rim, usually decidedly less than the diameter from the edge. The lateral margin often gently incurved at middle. (See fig. 78.)

Anal tergite with median portion of caudal margin smooth and slightly convex; each convex lateral portion with a rounded tubercular elevation at its middle as figured.

Sternites without special developments. The anal scale with caudal angle obtusely angular between the well-developed setigerous cones.

Gonopods as figured (fig. 79).

Width of male holotype, 8.1 mm.; females up to 10.8 mm. in width.

Locality: Sumatra: Lamprongs, Wai Lima. Several specimens taken by Karny and Siebers, November–December, 1921.

Platyrhacus (Platyrhacus) flavisternus Pocock

Platyrhachus flavisternus Pocock, *in* Weber, 1894, Zoologische Ergebnisse einer Reise in Niederlandisch Ost-Indien, vol. 3, p. 346, pl. 19, fig. 16.

Locality: Java: Tjibodas. One female taken in May, 1922.

Platyrhacus (Psaphodesmus) conifer, new species

Figures 80, 81

Dorsum brown, with keels and a median longitudinal stripe yellow.

Collum with four transverse series of tubercles, one along the anterior border of two tubercles, two over middle region of four tubercles each, and one on posterior border of six tubercles. The tubercles of the anterior series smaller than those of the other three. On the following tergites there are the usual three series of prominent tubercles, of which those of the posterior row are notably largest, and one is of acutely conical form. Normally six tubercles in each series. All but most posterior keels laterally excised. (For posterior keels see fig. 80.)

Gonopods of male with two principal prongs, of which one is furcate into two, as shown in figure 81.

Width of male holotype, 6 mm.

Locality: New Guinea: probably south New Guinea. Several specimens taken in 1909 by Dumas.

Platyrhacus (Psaphodesmus) conformatus, new species

Figures 82–84

Color of preserved type a nearly uniform brown above, without stripes. Legs a somewhat lighter brown.

Antennae of moderate length and thickness. Median sulcus on vertex of head deep, the vertex on each side of it strongly granular, not setose.

Dorsum well arched throughout length. Metazonites with three transverse rows of large contiguous tubercles which extend laterally onto bases of keels, the tubercles depressed. Tubercles of middle region of posterior row elongate oblong, the other subcircular in outline. Prozonites very finely granulose or roughened. Keels roughened ectally from tubercles to outer border which is smooth. Outer margin of second to fourth keels presenting three broad, blunt, and smooth teeth, of which the median is nearly obliterated on the fourth. Keels of fifth segment deeply excised at middle and bearing the pore, which is not visible from above, on the margin in the angle. All other pore-bearing keels similarly excised and conspicuously bidentate, the non-pore-bearing keels similar (see fig. 82). The caudal corner of keels in posterior region becoming more and more prolonged and bent back more and more caudad.

Anal tergite posteriorly semicircularly rounded, the caudal margin coarsely and rather weakly crenate and bearing a long coarse seta in each incision, of which there are six. Two setiferous tubercles on dorsal surface. Two setiferous tubercles on margin of pleural region of ring on each side.

Sternites with surface granular; without spines or setae. Anal scale with the usual two caudally directed setae borne on tubercles.

Gonopods with coxa bearing numerous setae on anterior surface. Femur with numerous setae on ventral and ectal surfaces. Few setae on tibial area. Telopodite presenting three slender, curved processes of which the two inner ones are confluent into a broad, thin, plate-like basal piece. (See figs. 83 and 84.)

Width, 9.5 mm.

Locality: New Guinea: Doormanpad. Two males and two females taken by W. C. Van Heurn, October, 1920, at 1800 to 2900 meters elevation.

Platyrhacus (Psaphodesmus) ethodus, new species

Figures 85, 86

Dorsum dark brown throughout, inclusive of keels, the legs lighter.

Antennae rather short, uniform in thickness. Granulation of head coarse, dense. Setae as usual.

Lateral wings of collum short, subtriangular, much depressed below strongly arched dorsum. Tubercles small, sharply elevated, well separated. Anterior series continuing along margin down upon keels on each side. Tubercles of posterior row moderately larger than others, typically 10 in number, not extending upon keels. Intermediate rows of four tubercles each, these widely separated.

Keels of second segment with anterior corner extending much beyond posterior, the lateral margin strongly oblique, crenate, the crenatures or nodules nearly uniform and typically five in number. Anterior margin of keels smooth, the posterior nearly so. Keels of third and fourth segments with lateral margins less oblique, nodules four in number. Fifth keels with five or six crenatures or rounded nodules. Pore on oblique outer surface almost contiguous with bases of middle crenations or teeth. On subsequent keels the teeth are often six or sometimes seven in number and more widely separated. Keels very short, upper surface strongly granular and bearing also two or more tubercles in line with those of dorsum. Caudal corners of posterior keels only moderately produced caudad.

Dorsum of segments strongly convex and elevated above keels, the surface in general strongly granular. Tubercles of all three series small, but conspicuously developed and elevated, those of caudal series a little largest, all widely separated.

Anal tergite with caudal margin semicircular, slightly incurved at middle. Sternites with well-developed, acutely pointed cones at bases of legs. Caudal tubercles of anal scale low and rounded, the margin between them wide and straight.

Gonopods illustrated in figure 86.

Width of female allotype, 9 mm.; of male holotype, 8.5 mm.

Locality: New Guinea: Pionierbivak. Six specimens, August 13, 1920.

Platyrhacus (Psaphodesmus) fratrellus, new species

Figures 87, 88

Probably yellowish throughout in life, but the metazonites of the holotype appear brown at first from an accumulation that is readily brushed off.

Head densely granular. The usual series of setae in clypeal region.

Collum strongly convex, a subtriangular keel projecting on each side. Convex middle region bearing four transverse series of uniform, well-spaced tubercles, one series along anterior border, one along caudal and two in between; the granules between tubercles and on keels much smaller.

Dorsum of ordinary segments strongly convex. Metazonites with tubercles of caudal series typically nine in number, well separated, much larger than those of the other two series. A patch of tubercles on keels, the patch widest at middle, these tubercles obviously larger than granules over proximal region of keels.

Keels of second and third segments with anterior corner projecting laterad well beyond posterior corner, the lateral margin crenate, crenations four. On fourth keels the anterior and posterior corners about equally prominent, while on succeeding keels the posterior corners become more and more produced. Lateral margin of keels of fourth and subsequent segments showing a median interval or excision which is wider on poriferous keels. The pores on slanting upper surface of edge. (See fig. 87.)

Anal tergite semicircular.

Sternites without processes. Anal scale trapeziform; caudal margin angularly produced between the caudal tubercles.

Gonopods with coxae glabrous or nearly so. Femur-tibia moderately setose on caudal (subventral) surface. Telopodite with a simple, slender, curved proximal branch and a wider distal blade ending in three slender, semicircularly curved spines. (See fig. 88.)

Width, 7 mm.

LOCALITY: North New Guinea: Prauwenbivak. Male holotype taken in September, 1920, by W. C. Van Heurn.

Metapidiothrix javana, new species

Figures 89–93

Body dark over dorsum and upper part of sides, the caudal borders of metatergites a more solid, nearly bluish color; lower part of sides and venter yellow. Legs and antennae yellow.

Antennae rather long; third article longest, slender, the fifth next in length, clavately widening distad, the sixth joint thickest, short. (See fig. 89.) Eye patch with ocelli in four somewhat irregular series: 5,5,4,2.

Collum narrowing acutely down each side, crossed with the usual transverse series of six coarse setae, each of which is borne on a tubercle.

Subsequent tergites also with the six setae, these coarse and borne on conspicuous tubercles, of which the outermost is set a little caudad of laterad from the middle one, its seta projecting caudad of laterad. In dorsal view the outline of the dorsum is serrate from the projecting tubercles, but the prominences are low and almost obliterated toward caudal end of body.

In the male the third legs are greatly thickened, but the other pregenital legs are of normal size without any special modification (cf. fig. 90).

Ninth legs of male with the second joint conspicuously crassate and the first joint a slender pedicel (fig. 91).

Gonopods of the male as shown in figures 92 and 93.

Last tergite posteriorly truncate with two slender papillae projecting from truncate end.

Length, near 5.5 mm.; width, 1 mm.

LOCALITY: Java: Tjibodas. One male taken in August, 1921, and four females in May, 1922, by Dammerman, at 1400 meters elevation.

Metapidiothrix sp.

LOCALITY: Poentjak. One female taken May 7, 1930.

This female, in not very good condition, measures 9 mm. in length.

Spirobolidae

JAVOLUS, NEW GENUS

Agreeing with *Pseudospirobolellus* in lacking a well-developed sternal plate in the anterior gonopods. Coxae of anterior gonopods contiguous at middle line as shown in figure 94. Differing from *Pseudospirobolellus* in the form of the posterior gonopods, which are broader and more lamellate instead of being in the form of a stylus or slender blade. Fifth legs of male with prominent coxal processes. Repugnatorial pores on the metazonites, beginning on sixth segment.

GENEROTYPE: *Javolus purmerendus*, new species.

Javolus purmerendus, new species

Figures 94–96

Typically dark gray-brown above, sometimes with more or less clearly defined annuli of lighter color; lower part of sides and the venter lighter. Legs yellowish. In two specimens, the last segment is black, and this is probably normal in living or fresh specimens.

Eyes transversely broadly subelliptic, separated by about one and a half their length; ocelli arranged typically in five transverse series: 7,8,8,7,4. Clypeal setigerous foveolae 4 + 4. No median sulcus across vertex, but a distinct one running from level of antennal sockets to lower margin.

Collum strongly narrowed down each side, with lower end evenly rounded in the female; in the male lower end somewhat broader, with anterior corners widely rounded and the posterior more angular; a fine margining sulcus below and up anterior border to level of eye on each side; otherwise no sulci or striae.

Ordinary segments constricted in front of posterior sulcus; the latter distinct across dorsum as well as down the sides. Anterior sulcus at or near posterior margin of preceding segment, also distinct throughout. Repugnatorial pore just behind the posterior or segmental sulcus, from which it is but little removed.

Anal tergite evenly convex behind, exceeded by the valves; the latter smooth, evenly convex, neither depressed nor elevated along mesial margin.

In the male the coxal processes of the fifth legs are conspicuous and sublamellar in form, narrowly rounded at apex and distally curved cephalad. Other coxae without processes.

Gonopods of the male as represented in figures 95 and 96. As shown in the last figure, the posterior gonopods extend abruptly backward distally a little above level of anterior gonopods.

Number of segments, 43–46.

Diameter, 2.5 mm.

LOCALITY: Java: Purmerend, Batavia Bay. Male holotype, female allotype, and two female paratypes taken in November, 1919.

Spirobolellus wachlerinus, new species

Figures 97, 98

The ground color of the body is yellow. There is a narrow, median, longitudinal black stripe and a broader black band on each side. Head yellow, appearing dusky above due to a fine net-work of dark lines. Antennae yellow. Collum black, except a yellow median area, a similarly colored wing on each side, and a low triangular yellow band at caudal margin bisected by the median black stripe. Anal tergite black. Legs yellow.

Head concavely depressed or excavated on each side for reception of antenna. Smooth, the median sulcus very lightly impressed. Eyes triangular; more than twice the transverse diameter apart; ocelli in four transverse series: 6,5,3,1, taken from base to apex. Antennae short; the sixth article abruptly thicker than the others.

Collum strongly narrowed down each side as usual, the ends well rounded, the caudal corner more obtusely and evenly rounded than the anterior. Margined along each side and up the anterior border.

Constricting furrow of the succeeding segments wide, shallow above, deep below. Metazonites higher than prozonites. Distinctly striate only below, the striae straight across metazonites and curving across prozonites on which they rise higher on the side, becoming fine and very oblique. Covered portion of prozonites smooth.

Pores high on side, small, near middle length of metazonite.

Anal tergite obtusely rounded behind, a little exceeded by the valves.

Sternite of anterior gonopods large, as usual, with the apical excision larger, more widely open or obtuse than in *chrysogrammus* and strictly angular, not rounded at bottom as in *solitarius*. See figures 97 and 98 for this and for characters of the posterior gonopods.

Number of segments, 37–40.

Diameter of male, 1.5 mm.; of female, 1.75–2 mm.

LOCALITY: Java Sea: Wachler Island, about 25 specimens, male and female, collected by Dammerman, October 22, 1921; Kombuis Island, several males and females taken January 27, 1922.

Rhinocricidae

Dinematocricus acompus, new species

Figures 99, 100

General color brownish black. Legs brown.

Sulcus of head widely interrupted in the frontal region. Setigerous foveolae 2 + 2.

Collum rounded and margined at lower ends in the usual way. The second tergite extending well below it, not excavated, strongly striate below, with striae bent upward anteriorly and running beneath collum.

Segmental sulcus not impressed above, disappearing in a shallow transverse furrow which is well marked. Surface above behind the furrow wholly smooth, becoming roughened toward edge of preceding metazonite, the overlapped portion of prozonite smooth. Segments strongly striate on sides below level of pores and in front of furrow, the striae curving obliquely upward and forward to, but not extending upon, the covered portion; striae over metazonite only below. Scobina beginning at about the eighth segment and extending to the thirtieth; each consisting of a small, deeply impressed, lunate mark, with striae indistinct or absent.

Anal tergite caudally rounded, strongly roughened over proximal portion, the caudal portion smooth, much exceeded by the anal valves. Valves with borders strongly compressed and elevated, not angled above.

Gonopods represented in figures 99 and 100.

Number of segments in male holotype, 52.

Width, 6 mm.

Locality: New Guinea: Pionierbivak. Two males taken June–August, 1920, by Van Heurn.

Dinematocricus eupistus, new species

Figures 101, 102

Dark brown or blackish, the prozonites mostly distinctly darker than the metazonites.

Median sulcus of head widely interrupted, not especially well impressed below. Foveolae 2 + 2.

Collum and second segment of usual form and relations.

Segments depressed across dorsum but sulcus not there obvious. Sulcus curved about side of pore and evident below this level in the depression. Striae on prozonites extending to level of pore, but present on metazonites only below. Anterior, deep impression of anterior scobina wide transversely, followed by series of striae as usual, becoming much smaller toward posterior end of series; the distance between scobina in anterior region greater than width; beginning on eighth or ninth segment and extending to segment XXX.

Anal tergite with anal process narrow, a little exceeded by the valves. Anal scale of usual shape. Gonopods as shown in figures 101 and 102.

Number of segments in male holotype, 51.

Width, 5.1 mm.

Locality: New Guinea: Doormanpad. One male taken in October, 1920, at 1410 meters elevation by Van Heurn.

Dinematocricus gonethus, new species

Figures 103, 104

Prozonites olive gray, the metazonites ferruginous or somewhat chestnut, a wide anterior border on collum, widest at middle, also of this color.

Antennae short, rather slender and nearly of uniform width. Median sulcus of head interrupted in frontal region. Head each side of sulcus in frontal and upper clypeal region marked with fine transverse striae, the surface in general smooth and shining. Setigerous foveolae 2 + 2.

Collum of typical form, narrowly margined in front below level of eyes, the margination continued on lower end. Second tergite extending well below end of collum.

Segmental sulcus on ordinary segments sharply impressed entirely about ring, contiguous with pore, above which it is slightly angled. Metazonite with longitudinal striae only beneath, elsewhere smooth and shining; the prozonites striate entirely up side, the striae oblique, and some of those above level of pore running transversely across dorsum. Scobina with anterior impressed line curved, relatively long, followed by a series of striae forming a triangular area that is shorter than the anterior width. Scobina beginning at eighth or ninth segment and extending to the twenty-eighth.

Anal tergite behind basal ring nearly triangular in outline, with apex narrowly rounded and sides nearly straight, equal to, or but little exceeding, the valves. Inner borders of valves only moderately compressed. Anal scale subtriangular.

Characterized especially by the gonopods, which are illustrated (figs. 103 and 104).

Number of segments, 44.

Diameter of male holotype, 5 mm.

LOCALITY: New Guinea: Pionierbivak. One male and one broken female collected by Van Heurn, June–August, 1920.

Dinematocricus kangeanus, new species

Figures 105, 106

A dark chocolate-colored or nearly black form with head, collum, and last tergite and anal valves lighter. Covered part of prozonites yellowish and caudal border of metazonites somewhat chestnut. Legs dark chocolate colored.

Clypeal foveolae 2 + 2. Median sulcus of head distinct across vertex and down to clypeal excavation, continuous.

Segmental sulci fine but distinct throughout. The segments not at all furrowed or constricted, smooth and shining.

Scobina with lunate impressions wide transversely; separated by a space clearly greater than their width. The striate area short, broader than long, posteriorly widely rounded.

Last tergite rounded behind, clearly exceeded by the anal valves.

Best characterized by features of male gonopods (figs. 105 and 106).

Diameter, 10 mm.

LOCALITY: Kangean Island, Tambajangau. One male taken by C. Backer in April, 1929.

Dinematocricus hadleyi, new species

Figures 107, 108

General color deep chocolate or nearly black, with a lighter annulus of ferruginous cast about caudal border of each ordinary metatergite, the collum similarly bordered both anteriorly and posteriorly. Legs chocolate-brown or sometimes lighter, the antennae deep chocolate or black.

Head with the usual median longitudinal sulcus across vertex and down the front to clypeal edge. Clypeal foveolae 2 + 2.

On ordinary segments the sulcus is distinct up the sides but is obliterated across the middorsal region; not excurved or angled at level of pore, with the rim of which it is contiguous. Tergites smooth above. Scobina with deep, relatively wide, lunate anterior impression followed by the usual finely striate area; separated by more than twice the width of a depression; beginning on the tenth segment and extending to about the thirty-eighth segment, but the scobina toward end of the series gradually reduced and fading out.

Anal tergite pointed behind, the apex narrowly rounded. The triangular caudal portion set off by transverse sulci; exceeded by the anal valves. Anal valves smooth.

Gonopods of male as represented in figures 107 and 108.

Number of segments in male holotype and female allotype, 54.

Length up to 130 mm.; width, to 10.5 mm.

LOCALITY: New Guinea. One male and three females taken in 1943 by James E. Hadley. (Types in the United States National Museum.)

Polyconoceras extrusus, new species

Figures 109, 110

General color fuscous, with caudal borders of metazonites chestnut. Legs also fuscous.

Sulcus of head continuous, though somewhat weaker for a short distance in frontal region. Foveolae 2 + 2.

Collum with surface smooth and shining, the lower ends rounded and margined as usual. The second tergite extending a little below it, striate beneath, with striae curving upward anteriorly as usual.

Segmental sulcus not evident above, but segment irregularly, shallowly furrowed in its place or with several weak wrinkles; sulcus weak on sides, subcontiguous with pore, above level of which it is weakly angled. Surface of dorsum smooth and shiny; segments striate on sides and below as usual; also some oblique striae above level of pore. Scobina consisting of a wide crescentic impression followed by the usual series of fine striae; extending to segment XXXV from segment VIII.

Anal tergite acutely triangularly narrowed caudad, the apex narrowly rounded; caudal portion set off by a sharply impressed transverse sulcus or this sulcus obscure; equaling valves. Anal valves compressed as usual, rounded above.

Gonopods as figured (figs. 109 and 110).

Width of male holotype, 8 mm.

LOCALITY: New Guinea: Pionierbivak. Two males taken by Van Heurn, June–August, 1920.

Trigoniulidae

Trigoniulus amnestus, new species

Figures 111, 112

Segments behind furrow, head, and collum ferruginous. Segments in front of furrow dark brown or nearly black down sides, the middorsal portion usually lighter. Antennae and legs also ferruginous.

Head smooth. Labral excision rectangular, a fine median sulcus extending from its apex continuously up to and across vertex. Supralabral setiferous pits 2 + 2, the two pits on each side widely separated. Eyes not extending mesad quite so far as inner edges of antennal sockets; eyes in outline subtriangular, the angles strongly rounded, upper side convex, the mesial straight, running moderately obliquely upward and mesad from lower angle. The usual depression for reception of basal joints of antennae.

Collum of usual general shape, being strongly narrowed down on each side and with anterolateral corner rounded. Anterior and lateral borders margined, the margining sulcus extending entirely across the plate.

Segmental sulcus obsolete, but indicated by the usual encircling weak constriction. Metazonites with diameter a little greater than that of the prozonites. Segments under lens appearing finely punctorugose along the constricting furrow, the rugae gradually fading out toward caudal border and on the covered anterior border, both of which are smooth; metazonites crossed below by close-set longitudinal striae which become sparse, widely separated, at the middle height of sides. Repugnatorial pore on prozonite contiguous, or nearly so, with position of suture.

Sternite very finely cross striate.

Anal tergite not exceeding the valves, bluntly recurved behind; a shallow transverse depression in front of caudal end. Anal valves compressed as usual. Anal scale with anterior margin essentially straight.

Tarsal pads present on all legs of male except first two and last few pairs.

For structure of gonopods see figures 111 and 112.

Width of male holotype, 3.5 mm.

LOCALITY: Java: Purmerend, Batavia Bay. Male holotype, female allotype, and several paratypes, November, 1919.

Harpagophoridae

Thyropygus baweanus, new species

Figure 113

Color of head, collum, and segments behind sulcus reddish brown or chocolate, under microscope appearing finely spotted with yellow, fulvous in front of sulcus. Legs pale.

Eyes more than their diameter apart; ocelli in six transverse series. Median sulcus of vertex distinct.

Collum with anterior margin incurved a little above anterolateral angle on each side opposite third article of antennae. Anterolateral corner well rounded, and lateral margin slightly convex. Caudal margin on each side bending a little back and meeting lateral margin at nearly a right angle. With a deep margining sulcus from level of eye along anterior margin, about each corner, and along lower side to caudal margin. One or two short sulci above lateral end of margining sulcus on each side.

The segmental sulci deeply impressed, curving opposite the pores from which they are widely removed. Metazonites with sharply impressed longitudinal striae below and up side part way to the pore. Prozonites without longitudinal striae, but the usual fine, encircling cross striae which above cover only a little more than anterior half of zone but below cover it entirely.

Cauda much exceeding the valves, slightly curved, the tip blunt.

Characterized especially by the gonopods as shown in figure 113.

Segments of male holotype, 61; of female allotype, 55.

Diameter of holotype, 7.2 mm.; of female allotype, 8.2 mm.

LOCALITY: Bawean Island. One male holotype and one female allotype and a partly grown specimen taken February 6, 1920, by Dammerman.

Thyropygus cherus, new species

Figures 114, 115

A conspicuously banded form, the prozonites being gray and the metazonites dark brown, more reddish at caudal margin. Collum and head dark brown, the former lighter about border. Antennae and legs lighter brown. Anal valves dark brown, the elevated borders reddish.

Vertex of head crossed by a sharply impressed sulcus which ends abruptly at level of a line connecting inner angles of eyes. Setae just above labral area 4 + 4. Labral setae 12 + 12; the three median labral teeth continued dorsad as ridges across labral region. Eyes much more than their length apart; subtriangular, the dorsal margin convex, the mesial angle acute, the ventral one obtuse, and the ectal one rounded; ocelli numerous and distinct, arranged in seven transverse series.

Antennae short, the articles, except the first and the sixth and seventh, strongly clavate, short, and thick. (See fig. 114.).

The collum narrowed down the sides as usual, the anterior margin on each side a little widely concave and then convexly rounding about the lower corner; strongly margined below and up the front to the level of the eye. A series of short, longitudinal striae on each side above lower margin, smooth and shining above (fig. 115).

Segmental sulcus deeply impressed, excurved opposite each pore, to which it is close. A longitudinal stria across prozonite and metazonite along middorsal line. Surface minutely and rather obscurely punctate and with short, irregular, impressed lines. Metazonites with deep longitudinal striae below and up sides to level of pore. Striae across prozonite below, the anterior ends of the striae bending dorsad.

Last tergite with fine coriarious markings as on other segments, the cauda free, but not exceeding valves, and curved a little upward, the apex bluntly rounded.

Anal scale marked off by a sulcus from the ring, this sulcus on each side running out parallel with, and close to, the caudal margin; posterior angle obtuse. Anal valves with mesial borders compressed and moderately elevated.

Number of segments, 58.

Diameter, 10 mm.

LOCALITY: Sumatra: Wai Lima. A female taken by Karny and Siebers, together with a partly grown specimen and several young ones, November–December, 1921.

Thyropygus krakataunus, new species

Figure 116

Original coloration uncertain because of long preservation of specimen. The metazonites of segments appear to have been brown or reddish brown, the prozonites abruptly paler.

Antennae short, the fifth article strongly clavate and thicker than the fourth, sixth article subspherical with distal end truncate, seventh article abruptly narrower. The vestigial sulcus fine, vertex each side of it smooth. Eyes separated by more than their diameter; elongate transversely, subtriangular in outline, the mesial angle acute, the ectal rounded, and the ventral one obtuse; the dorsal side convex.

The collum with the usual general form; strongly margined along each side and up anterior margin to level of eyes; above margining sulcus on each side, two or three short sulci with trace of a third or fourth running from caudal margin forward.

Segmental sulci deeply impressed, excurved opposite pore as usual. Metazonites with deeply impressed longitudinal striae, the striae present more than half way up to pore. Prozonites with encircling striolations over anterior portion as usual, the posterior portion not punctate.

Cauda not greatly exceeding the valves, straight, bluntly rounded.

Anal scale free from the ring.

Gonopods of general structure presented in *javanicus*, but the spine at "knee" of femur not two-pointed, etc. (see fig. 116).

Segments of male holotype, 55; of female allotype, 57.

Diameter of holotype, 7 mm.; of allotype, nearly the same.

LOCALITY: Krakatau. Male holotype, female allotype, and several paratypes taken by Dammerman, April 25, 1919.

Thyropygus magister, new species

Figures 117, 118

Metazonites dark reddish brown, the prozonites a lighter brown. Collum, head, and anal valves dark reddish brown, with margins of valves and of last tergite a lighter red. Antennae reddish brown or chestnut, the legs brown.

Head with sulcus and eyes nearly as in *cherus*. Setae above labral area apparently only 3 + 3. The labral border not set off sharply at sides as in *cherus* and the median depressed area without distinct dental ridges; labral setae apparently 12 + 12, the foveolae extending out upon rounded lateral corner where much reduced in size. The antennae with joints longer than in *cherus*. (See fig. 117.)

Collum of usual general shape. Lower marginal ridge not so thick relatively as in *cherus*. Immediately above this ridge a depressed area in which there are two deep sulci extending from caudal margin part way across the plate. (See fig. 118.) Smooth and shining above.

Segmental sulci fine but distinct throughout, excurved at level of pore from which separated by nearly the diameter of the pore. Surface above appearing smooth and shining, the microscope revealing minute and largely obscure punctae only. Metazonites with coarse longitudinal striae beneath, these abbreviated above and not extending wholly to level of pore. Exposed portion of prozonites without striae except a few very fine ones just above outer end of stigmal slit; covered portion with the usual transverse striolations.

Anal tergite with caudal process straight and short, tip bluntly rounded, free but exceeded by valves. Mesial border strongly compressed, more elevated than in *cherus*. Anal scale with lateral limiting sulcus evident only at outer ends, the anterior region being smoothly continuous with the ring of the segment.

Number of segments, 66.

Diameter, 18.2 mm.

LOCALITY: Sumatra: Wai Lima. Collected by Karny and Siebers, November–December, 1921.

Thyropygus karimonus, new species

Figures 119–122

Coloration of typical segments at present somewhat chocolate colored behind the sulcus, the color in front of caudal margin more or less chestnut; anterior portion of segment light brown to yellowish, collum chocolate colored. Last segmental ring and anal valves abruptly lighter in color. Legs brownish yellow.

Antennae moderately short, with the articles proportioned nearly as illustrated for *cherus*.

Collum in general form also much as in *cherus*, but the marginal thickening narrower below over posterior portion (fig. 119).

Cauda much exceeding the valves, but little upcurved at end (fig. 120).

Gonopods of the male as shown in figures 121 and 122.

Number of segments in the male holotype, 61.

Diameter of male holotype, 10 mm.

LOCALITY: Java: Karimon Djawa Island, Karimon Djawa. A male and female taken by Selsman, September, 1920.

Thyropygus kangeanus, new species

Figures 123, 124

In structure of male gonopods very close to *T. karimonus*. In the male the collum differs from the latter species in having the antero-inferior corner produced with the thickened border of that part narrower and in other details as shown in figure 123.

The cauda is relatively shorter than in *karimonus* and is concave above instead of being straight, as shown in figure 124. The color pattern differs in that the dark annuli are much narrower in comparison with the light ones, embracing only the caudal border of the metazonites.

Diameter of male holotype, 9 mm.

LOCALITY: Kangean Island, Tambajangau. Collected by C. Backer, April, 1919.

Cambalidae

JAVICHUS, NEW GENUS

Repugnatorial pores beginning on segment V. Metazonites dorsally smooth, without trace of longitudinal ridges of keels.

Gonopods of male consisting of two pairs. The anterior bear no flagella; composed of two large joints, the coxa and undivided telopodite. Posterior gonopods not showing division into separate articles.

Ventral plate of first legs of male undivided but retaining a suture between the halves. First legs reduced in size but composed of full number of joints and terminating in a straight claw.

Second legs of male unmodified except for the genital processes from posterior side of coxae, those in generotype prominent, subcylindrical, and distally truncate.

GENEROTYPE: *Javichus monilus*, new species.

Javichus monilus, new species

Figures 125–127

Dark brown, in part nearly black, except lower part of head and the first two segments which are lighter, somewhat orange. Legs brown with antennae much darker, black or nearly so.

Antennae short, moderately clavate; second article longest; the third, fourth, and fifth not much differing in length from one another; sixth article thick cylindrical; seventh article broad but very short, only a little projecting out of the sixth, with the four sensory cones connivent at the middle of its distal face. Eyes with ocelli numerous, arranged in five or six longitudinal series: 3,4,4,4,2,1. Labral margin without definite teeth, the crenatures nearly obsolete.

Collum strongly narrowed down the sides. The lower margin short with inferocaudal corner strongly rounded. Dorsal surface strongly setose.

The succeeding segments conspicuously constricted, giving the body a submoniliform appearance. Surface of tergites lacking granules, ridges, or rugae, smooth; subdensely clothed throughout with fine and very short erect setae.

Last tergite with caudal margin nearly straight, not at all projecting over the valves. Anal valves with mesial borders neither compressed and produced nor nearly in a furrow; surface setose.

Gonopods as illustrated in figures 125, 126, and 127.

Number of segments, 42.

Diameter, 8 mm.; length, about 16 mm.

LOCALITY: Java: Tjibodas. One male taken by Dammerman in August, 1921, at 1400 meters elevation.

Cambalopsis tjampeana Attems

Cambalopsis tjampeana ATTEMS, 1903, Zool. Jahrb., vol. 18, p. 68, pl. 6, figs. 28–37.

LOCALITY: Java: Tjibodas. One young specimen taken by Dammerman, May, 1922.

Polyzonidae

PAROCONUS, NEW GENUS

Most nearly related to *Siphonoconus* but differing in various significant points.

Head of the same form with the two eyes in similar position. Seventh article of the antennae sunk in the sixth, not freely projecting. Tergites smooth. Pleurites all free from the tergites.

Anal ring complete, the sternite not separated. Penult segment lacking legs and sternite, the pleurites separated by an open slit, not overlapping as in *Siphonoconus*.

Anterior gonopods with coxae completely fused but with median suture preserved and visible; telopodite with first two joints strongly developed. Posterior gonopods with coxae also fused and preserving median suture, wholly lacking the conspicuous processes present in species of *Siphonoconus;* telopodite composed of four distinct segments instead of three. The terminal joint similarly long and thin.

GENEROTYPE: *Paroconus paurodesmus*, new species.

Paroconus paurodesmus, new species

Figures 128–130

Venter and legs light yellow, the dorsum and antennae with an unevenly suffused brownish tint over yellow.

Differing from described species of *Siphonoconus* in smaller number of segments which in the adult male from Batavia is 33. In the specimens from Krakatau, the number varies from 30 to 35.

Head of the usual general form, shown in figure 128. Antennae short and subcylindrical, less clavate than in previously known species, also differing from the latter in having the seventh article completely sunken in the sixth with only tips of the cones showing in lateral view. Collum extending over head and concealing eyes from above and at least partly so from in front. (See fig. 128.)

Anal and penult tergites long. The anal tergite abruptly narrower than the penult, rounded above posteriorly.

Gonopods of the male as shown in figures 129 and 130.

Length of male holotype, 4 mm.; width, 65 mm. Length of largest female, 7 mm.; width, 0.9 mm.

LOCALITIES: Java: Batavia. One male, March, 1921.

Krakatau: One male holotype and four females taken in September, 1920.

UPSIMA, NEW GENUS

Antennae with seventh article exposed, not retracted into the sixth.

Agreeing with the polyzonine forms in having the lower ends of the anal ring not fused, but differing from the other known genera in that these ends do not overlap or meet, being separated by a membranous area. Penult ring with lower ends not meeting, also separated by a membranous area. (See fig. 131.)

Vasa deferentia of male opening through processes of the coxae of second legs.

GENEROTYPE: *Upsima princeps*, new species.

Upsima princeps, new species

Figures 131, 132

Dorsum yellow, irregularly suffused with purple. Antennae also purple over a yellow background and the legs clear yellow.

Eyes partly covered in dorsal view by the collum.

Dorsum in comparison with related forms rather broad; the tergites widely arched and without keels or tubercles laterally; pores widely removed from lateral and caudal borders. Features of caudal segments as shown in figure 131.

Efferent genital processes from coxae of second legs of male directed caudad, slenderly cylindrical.

Gonopods of male as represented in figure 132.

Number of segments in male holotype, 26; in female allotype, 29.

Length of female allotype, 5 mm.; width, 0.75 mm.

LOCALITY: Princes Island. Male holotype, female allotype, and several female paratypes, January, 1922.

Siphonophoridae

Siphonophora praecisa, new species

Figures 133–135

Color pale yellow throughout.

Rostrum short, about equal in length to the head. Antennae strongly clavate, with the sixth article much thicker and longer than the others and the exposed part of the seventh very short; fifth article with a conspicuous sensory pit on its distal border.

Tergites evenly convexly arched but depressed so as to be semi-elliptic rather than semicircular in cross section; not laterally keeled or tuberculate.

The dorsum densely setose with very short erect hairs as usual.

The gonopods of the male as shown in figures 133, 134, and 135.

Number of segments in the male holotype, 41.

Width, 0.85 mm.; length, about 9 mm.

LOCALITY: Java: Pangrango. Male holotype and one immature specimen taken in August, 1921, by Dammerman, at 2400 meters elevation.

Platydesmidae

ZINAZONIUM, NEW GENUS

Resembling *Phaeacobius* in having across the metazonites rows of tubercles bearing numerous short sensory hairs, which also clothe the surface between the tubercles. It differs conspicuously from this genus, however, in having the side wings of the tergites much wider than long as in *Platydesmus*, etc. On each side of the middle of each ordinary tergite two large tubercles confluent at base into a longitudinal ridge, and on each side of these two transverse series of few, much smaller, and widely separated tubercles. First tergite not covering the head, bearing a curved posterior submarginal row of large tubercles and a shorter transverse series of smaller tubercles in front of it. Last tergite a little surpassing the anal valves. Pleurites with ectal ends completely fused with tergites, but free from sternite; the latter broad.

Gonopods of male primitive; divisions retained and clearly evident; coxae of both pairs large, mesially in contact. Repugnatorial process beginning on the sixth segment, as in *Fioria.*

GENEROTYPE: *Zinazonium leeuweni,* new species.

Zinazonium leeuweni, new species

Figures 136, 137

The dorsum, including bases of lateral keels, pale brown. The outer half of keels and the apices of the tubercles yellow. Legs and ventral surface yellow.

Body moderately broad in outline, being about six and three-fourths times as long as greatest width.

Head densely clothed with short hairs like those on tergites.

Collum a little wider than head, its anterior margin nearly straight, or its lateral ends with its large tubercle projecting a little forward; caudal margin on each side rounding forward. Typically eight large tubercles in posterior row adjacent to caudal and lateral margin. Dorsum strongly convex, with the keels curving out subhorizontally a little above level of bases of legs. Keels of immediately succeeding tergites bent strongly forward, those of the second segment nearly attaining the level of the anterior margin of the collum. Distal ends of anterior keels rounded; in the fifth the anterior corner the more produced, but behind the sixth the posterior corners of keels protruding more and more acutely. Keels of middle region somewhat sigmoidal in outline, bending first forward and then caudad. In caudal region curved strongly back, those of the penult segment running directly caudad and equaling or slightly exceeding the anal tergite, the latter caudally rounded. clearly exceeding the anal valves.

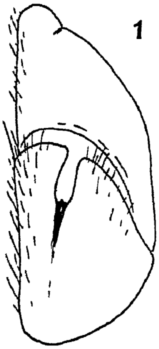
On typical tergites the posterior tubercle of the submedian two on each side conspicuously larger than the anterior, projecting a little caudad. Anterior row of tubercles on each side consisting of from two to five widely separated, smaller tubercles, four being the prevalent number; the posterior row composed mostly of two or three well-separated tubercles of which the mesial one is conspicuously largest.

Gonopods with proportions and structure shown in figures 136 and 137.

Segments of body mostly 66–68.

Length, 30 mm.; greatest width, 4.5 mm.

LOCALITY: Sumatra: Sibolangir. A dozen specimens, adult and young, collected by Leeuwen in September, 1920, at an elevation of 1500 meters.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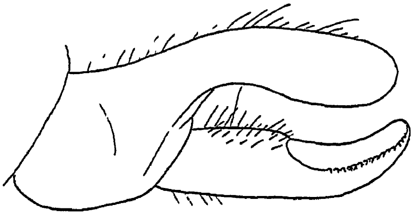
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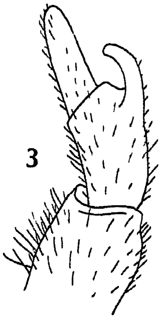
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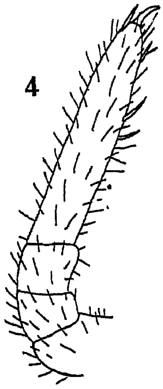
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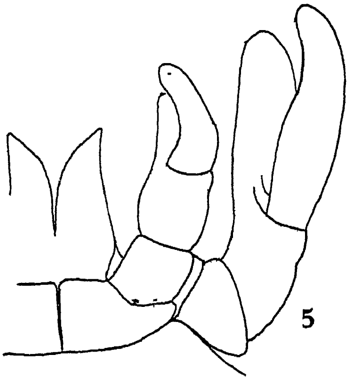
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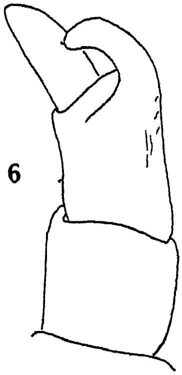
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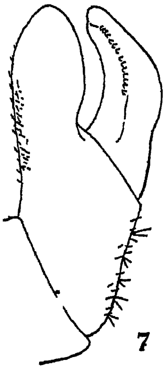
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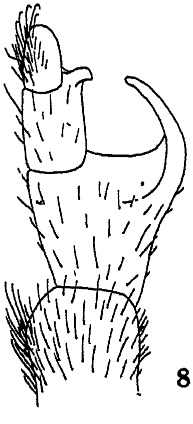
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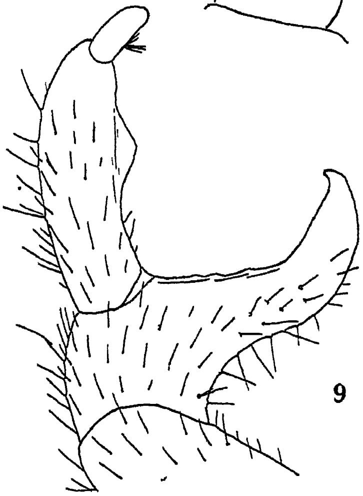
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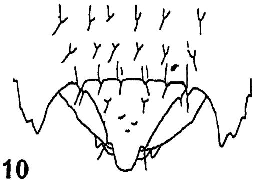
Fig. 1. *Sphaeropoeus lamprongsis*, new species, vulva of female.
Fig. 2. Idem, second right gonopod of male, caudal view.
Fig. 3. Idem, first right gonopod of male, caudal view.
Fig. 4. *Zephronia moderata*, new species, distal articles of leg, showing claw and spines.
Fig. 5. Idem, anterior view of right gonopods of male.
Fig. 6. *Zephronia tivia*, new species, first gonopod of male, subcaudal view.
Fig. 7. Idem, second gonopod of male, caudal view.
Fig. 8. *Tonkinobelum sumatrense*, new species, first gonopod of male, mesocaudal view.
Fig. 9. Idem, second gonopod of male, caudal view.



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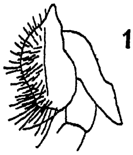

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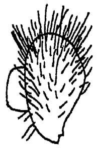

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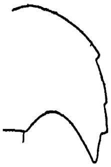

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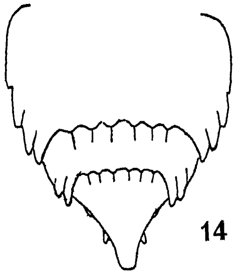

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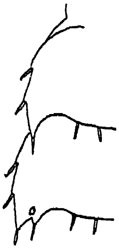

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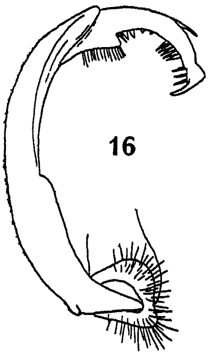

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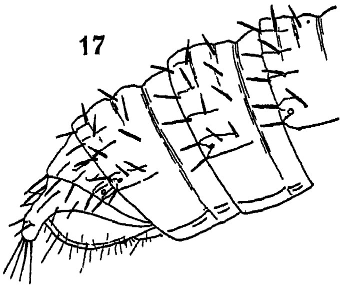

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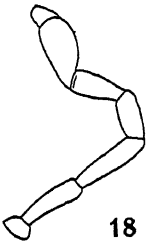

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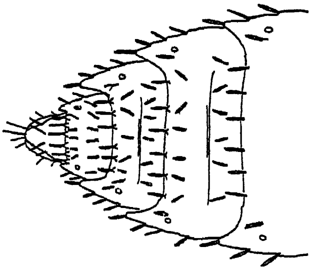

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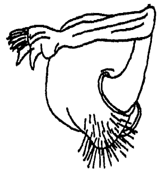

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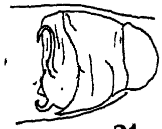
Fig. 10. *Opisthoporodesmus silvestri*, new species, caudal end, dorsal view.
Fig. 11. Idem, right vulval process, lateral view.
Fig. 12. Idem, right vulval process, ventral view.
Fig. 13. *Opisthoporodesmus conservandus*, new species, fourteenth right keel in outline.
Fig. 14. Idem, caudal end, dorsal view, in outline.
Fig. 15. *Opisotretus euthus*, new species, fourteenth and fifteenth left keels in outline.
Fig. 16. Idem, left male gonopod, subventral view.
Fig. 17. *Opisotretus mimus*, new species, caudal end of body, lateral view.
Fig. 18. *Retrodesmus dammermani*, new species, antenna in outline.
Fig. 19. Idem, posterior end of body, dorsal view.
Fig. 20. Idem, right gonopod, ventral aspect.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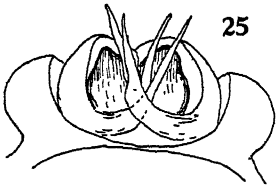
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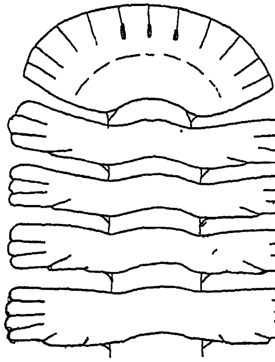
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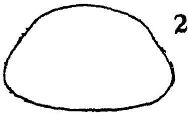
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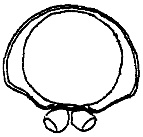
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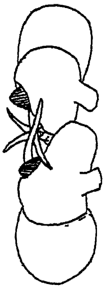
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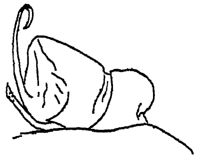
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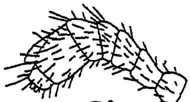
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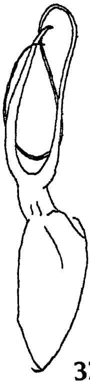
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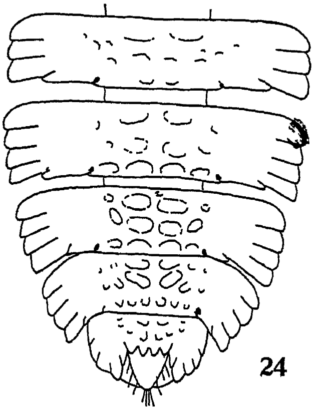
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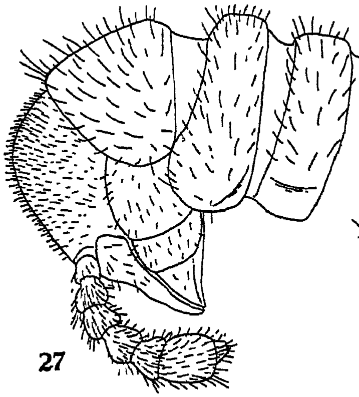
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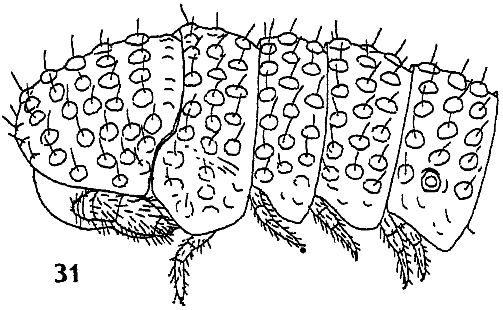
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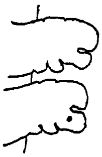
Fig. 21. *Cryptocorypha tobana*, new species, right gonopod of male, ventral view.
Fig. 22. Idem, right gonopod of male, anterior view.
Fig. 23. *Cryptocorypha leia*, new species, anterior segments, dorsal view.
Fig. 24. Idem, posterior segments, dorsal view.
Fig. 25. Idem, gonopods of male, anterior view.
Fig. 26. Idem, gonopods of male, ventral view.
Fig. 27. *Elatosus pygmaeus*, new species, anterior end of body, lateral view.
Fig. 28. Idem, collum in outline, dorsal view.
Fig. 29. Idem, cross section of a typical segment.
Fig. 30. *Porauxus pangrangus*, new species, antenna.
Fig. 31. Idem, anterior portion of body, lateral view.
Fig. 32. Idem, right gonopod, ectal view.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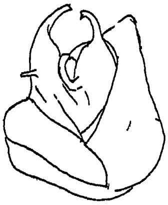
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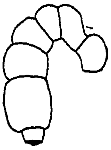

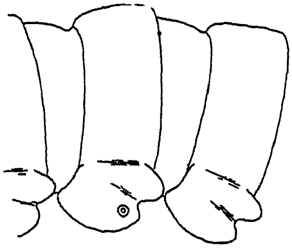
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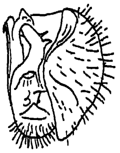
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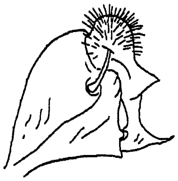
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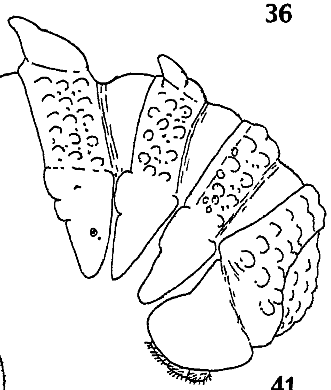
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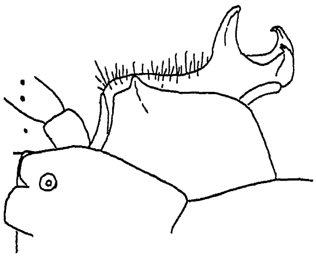
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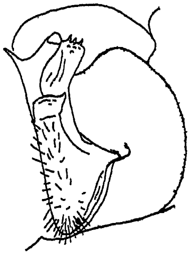
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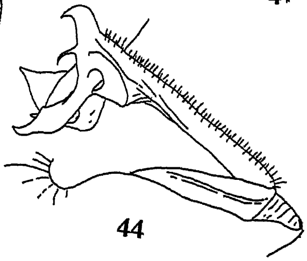
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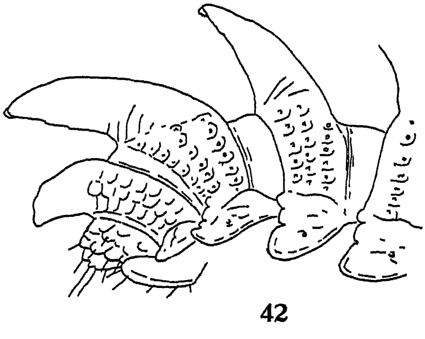
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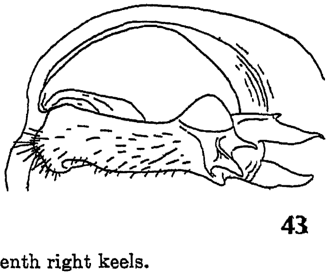
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Fig. 33. *Cryptyma javana*, new species, sixth and seventh right keels.
Fig. 34. Idem, left gonopod of male, caudoventral view.
Fig. 35. *Aphlotes litus*, new species, antenna.
Fig. 36. Idem, seventh and eighth tergites, lateral view (male) with granules and setae omitted.
Fig. 37. Idem, left gonopod of male, ventral view.
Fig. 38. Idem, right gonopod of male, mesial view.
Fig. 39. *Aphlotes auctus*, new species, left gonopod of male, ventral view.
Fig. 40. Idem, left gonopod of male, *in situ*, ectal view.
Fig. 41. *Hoplitesmus enoplus*, new species, anterior segments, lateral view.
Fig. 42. Idem, caudal segments, lateral view.
Fig. 43. Idem, right gonopod of male, ventral view.
Fig. 44. Idem, right gonopod of male, ectal view.

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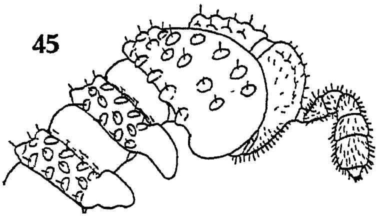

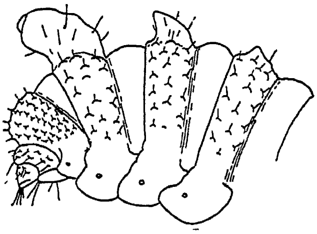

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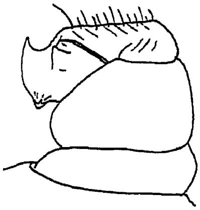

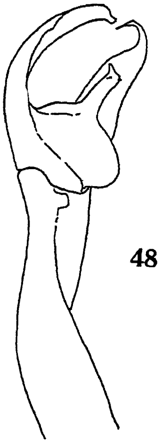

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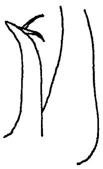

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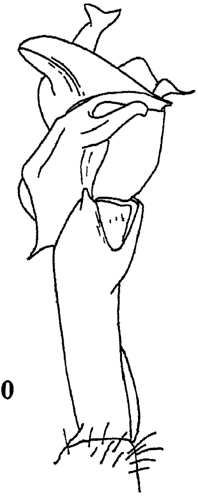

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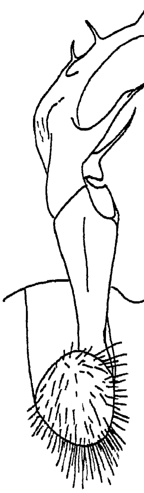

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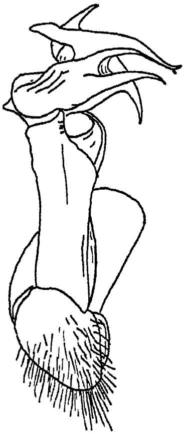

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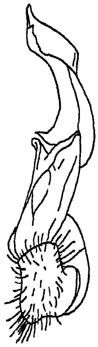
Fig. 45. *Pauroplus analdes*, new species, anterior end, lateral view.
Fig. 46. Idem, posterior end, lateral view.
Fig. 47. Idem, right gonopod, *in situ*, lateral view.
Fig. 48. *Oxidus sequens*, new species, right male gonopod, distal portion, ventral view.
Fig. 49. Idem, mesial view of ventral branch of telopodite of gonopod.
Fig. 50. *Oxidus lamellifer*, new species, gonopod of male.
Fig. 51. *Oxidus filarius* (Attems), right gonopod of male, ventral view.
Fig. 52. *Oxidus pygmaeus* (Pocock), right gonopod of male, ventral view.



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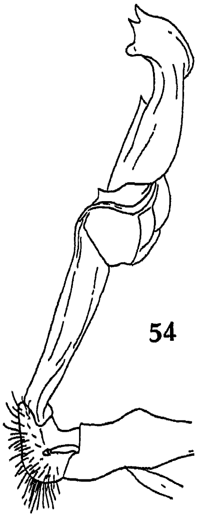

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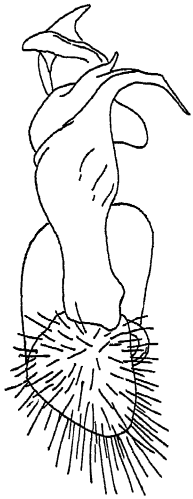

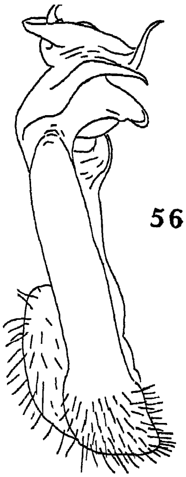

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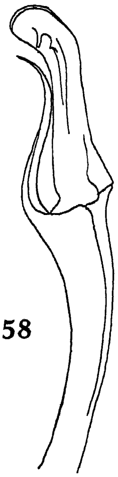

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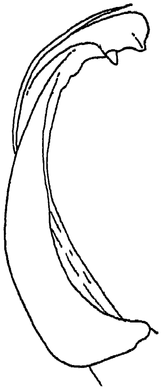

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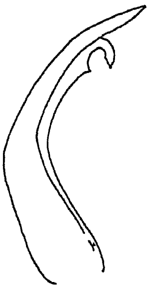

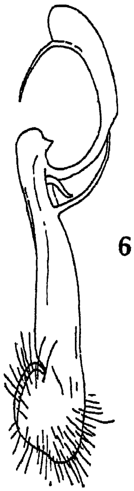

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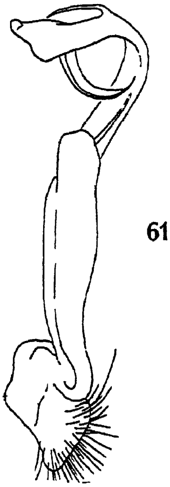
- Fig. 53. *Oxidus annex*, new species, left gonopod, ventral view.
- Fig. 54. Idem, right gonopod, mesial view.
- Fig. 55. *Oxidus malabarus*, new species, right gonopod of male, ventral view.
- Fig. 56. *Oxidus pangrangus*, new species, right gonopod of male, ventral view.
- Fig. 57. *Orthomorpha consocius*, new species, left gonopod of male, subventral view.
- Fig. 58. *Orthomorpha eupistum*, new species, left gonopod, ventral view.
- Fig. 59. Idem, ectal view of apical part of right gonopod.
- Fig. 60. *Papuosoma cladis*, new species, right gonopod of male, ventral view.



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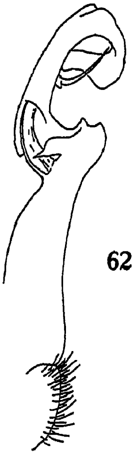

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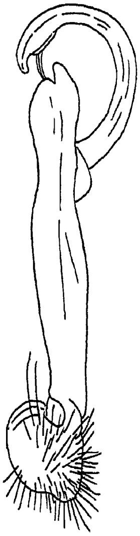

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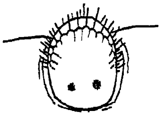

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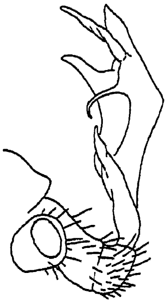

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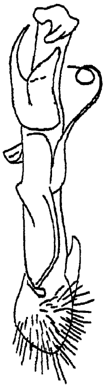

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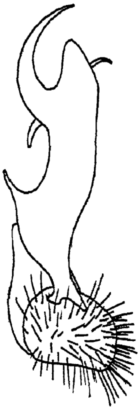

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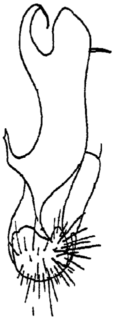

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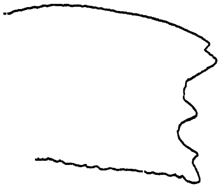
Fig. 61. *Papuosoma prodelum*, new species, right gonopod, subventral view.
Fig. 62. Idem, left gonopod, submesial view.
Fig. 63. *Papuosoma typonotum*, new species, right gonopod, ventral view.
Fig. 64. *Caloma agametum*, new species, right gonopod, ventral view.
Fig. 65. *Xenosoma atyches*, new species, sternal process of fifth segment of male, caudoventral view.
Fig. 66. Idem, right gonopod, ventral view.
Fig. 67. Idem, right gonopod, *in situ*, ectal view.
Fig. 68. *Xenosoma sonandrum*, new species, right gonopod of male, ventral view.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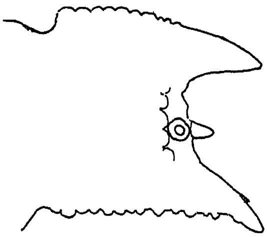
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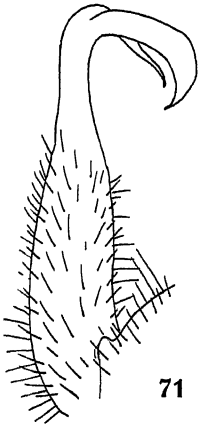
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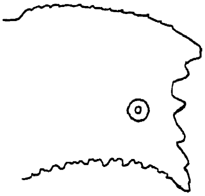
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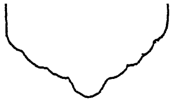
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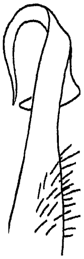
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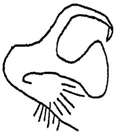
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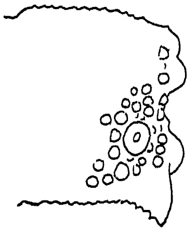
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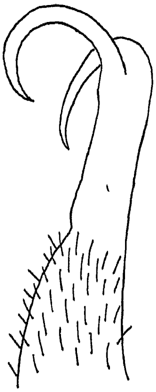
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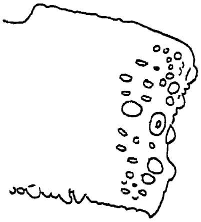
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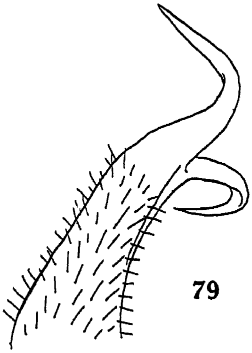
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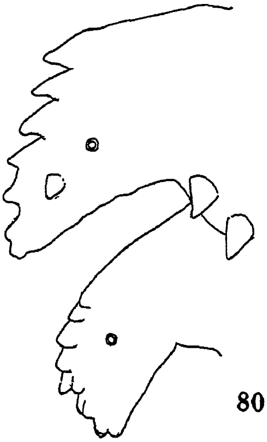
Fig. 69. *Platyrhacus* (*Platyrhacus*) *acmophorus*, new species, second right keel in outline.
Fig. 70. Idem, twelfth right keels in outline.
Fig. 71. Idem, left gonopod of male, ectal view.
Fig. 72. *Platyrhacus* (*Platyrhacus*) *doormanpadus*, new species, twelfth right keel.
Fig. 73. Idem, last tergite in outline.
Fig. 74. Idem, left gonopod, ventral view.
Fig. 75. Idem, left gonopod, distal view.
Fig. 76. *Platyrhacus* (*Platyrhacus*) *parabates*, new species, twelfth right keel.
Fig. 77. Idem, right gonopod, ventral view.
Fig. 78. *Platyrhacus* (*Platyrhacus*) *relaxus*, new species, twelfth right keel.
Fig. 79. Idem, right gonopod, ventral view.



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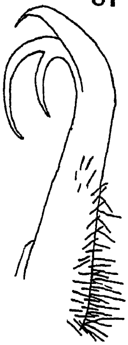

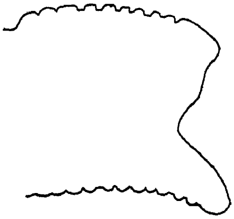

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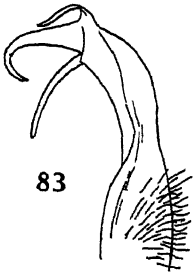

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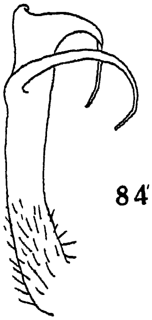

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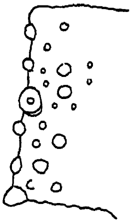

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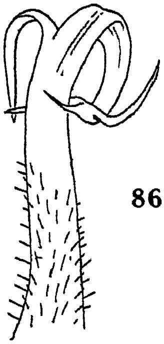

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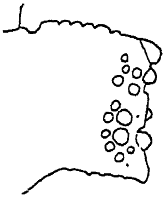

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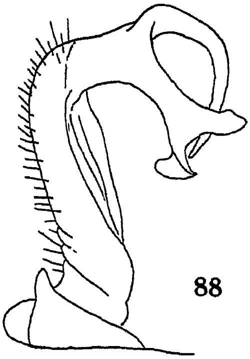

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Fig. 80. *Platyrhacus* (*Psaphodesmus*) *conifer*, new species, eighteenth and nineteenth left keels.
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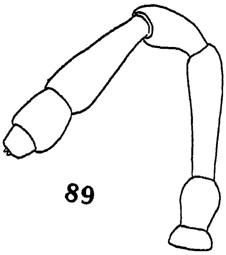
Fig. 88. Idem, left gonopod, subanterior view.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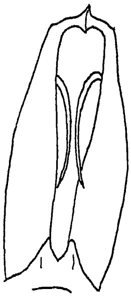
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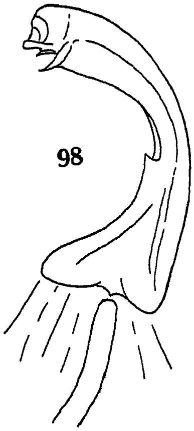
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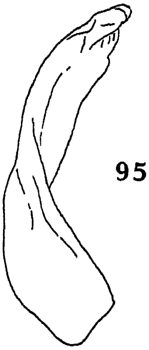
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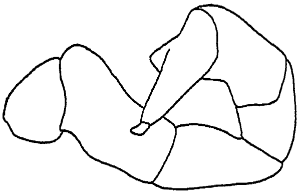
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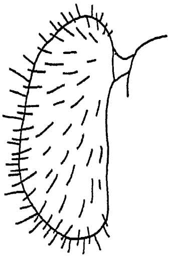
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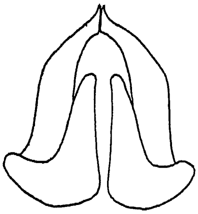
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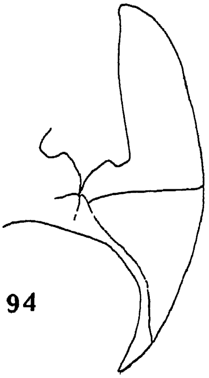
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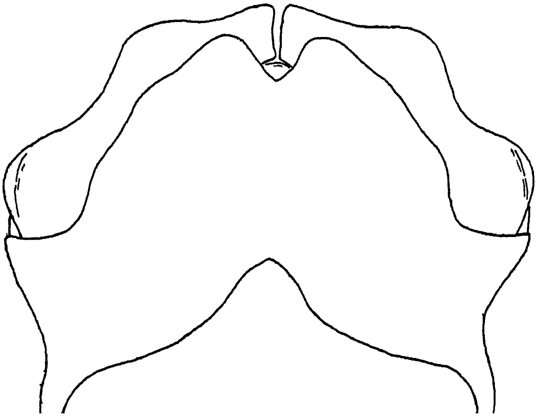
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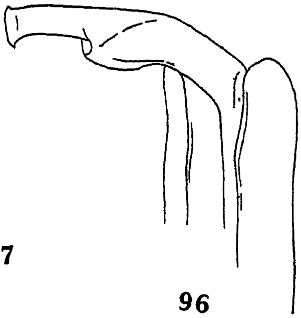
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Fig. 89. *Metapidiothrix javana*, new species, antenna in utline.
Fig. 90. Idem, third left leg of male, view a little ventrad of caudal.
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Fig. 97. *Spirobolellus wachlerinus*, new species, anterior gonopods. cephalic aspect.
Fig. 98. Idem, right posterior gonopod, cephalic aspect.

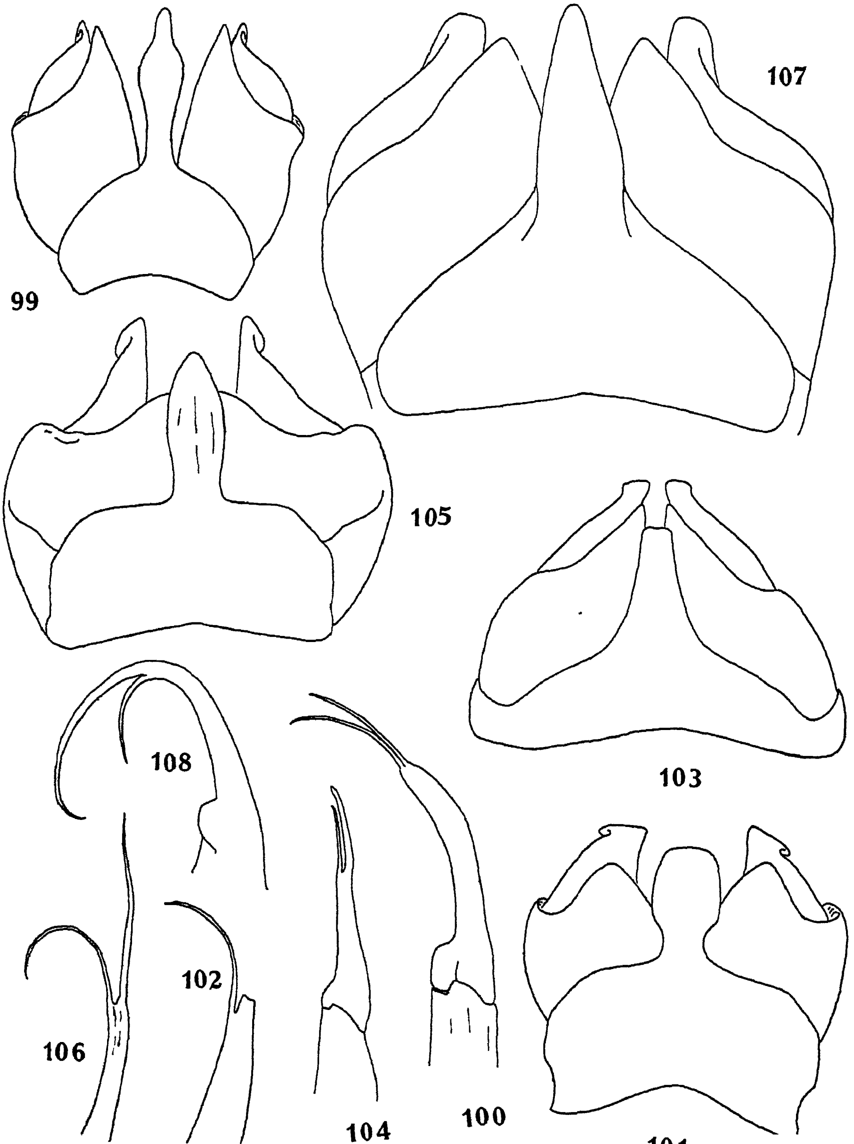

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Fig. 107. *Dinematocricus hadleyi*, new species, anterior gonopods and sternite.
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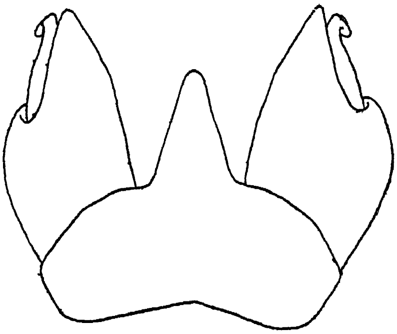

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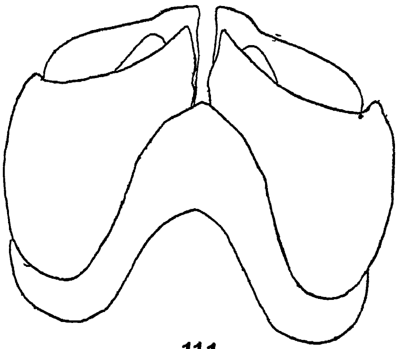

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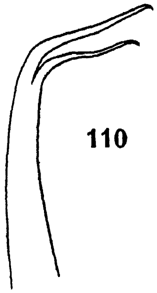

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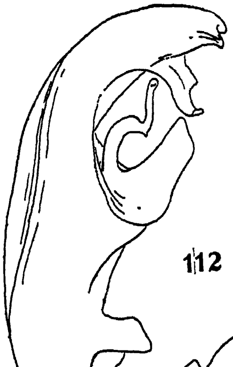

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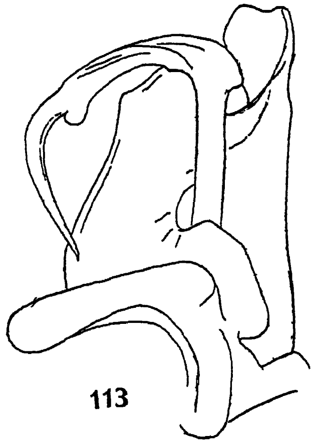

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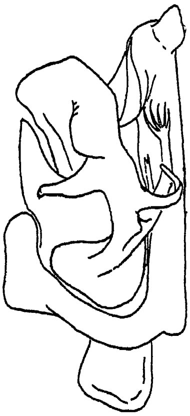

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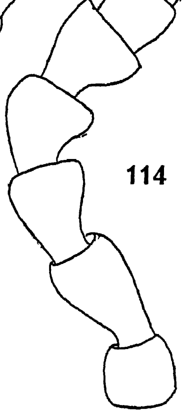

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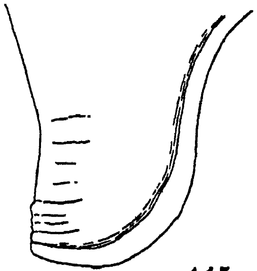

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Fig. 109. *Polyconoceras extrusus*, new species, anterior gonopods and sternite of male, cephalic aspect.
Fig. 110. Idem, distal portion of posterior gonopod, caudal aspect.
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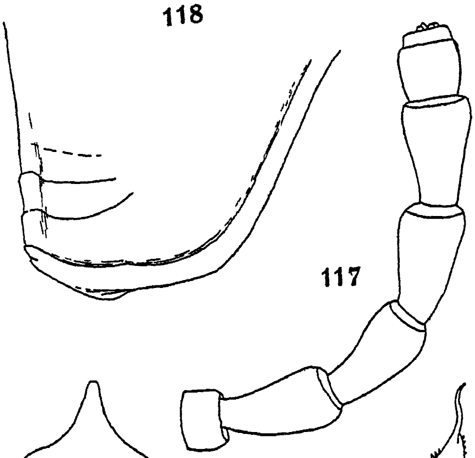
Fig. 113. *Thyropygus baweanus*, new species, right gonopods, caudal view.
Fig. 114. *Thyropygus cherus*, new species, antenna.
Fig. 115. Idem, lower end of collum, right side view.
Fig. 116. *Thyropygus krakataunus*, new species, right gonopods, caudal view.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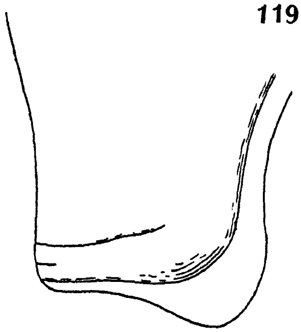
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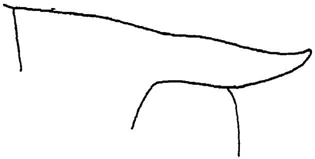
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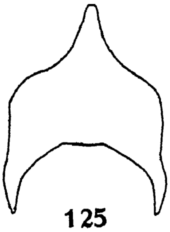
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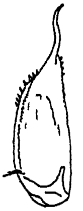
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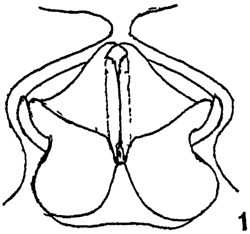
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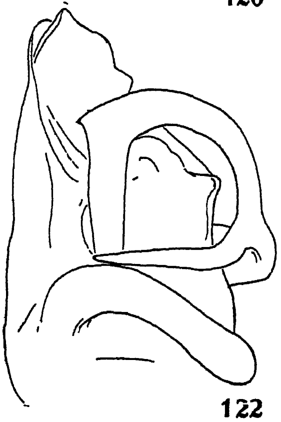
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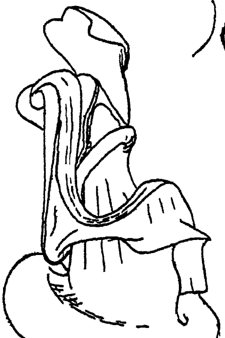
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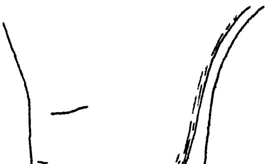
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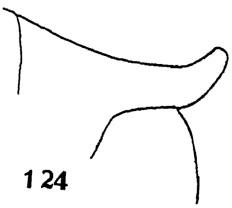
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Fig. 117. *Thyropygus magister*, new species, antenna.
Fig. 118. Idem, lower part of collum, right side.
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Fig. 125. *Javichus monilus*, new species, sternite of anterior gonopods.
Fig. 126. Idem, anterior gonopods, *in situ*, ventral view.
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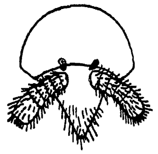

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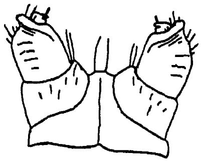

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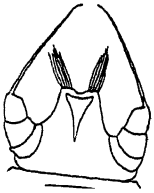

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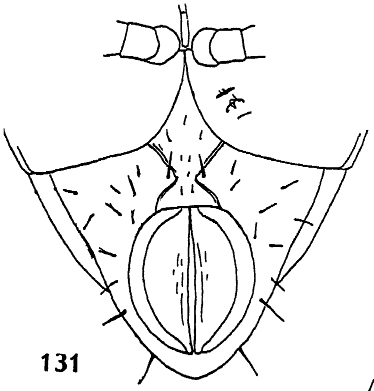

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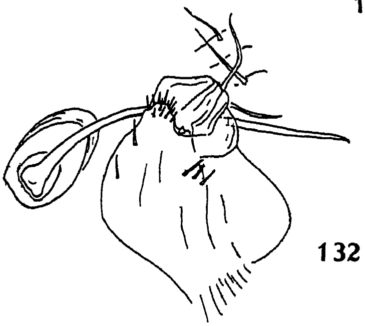

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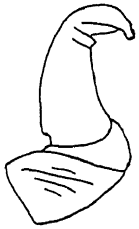

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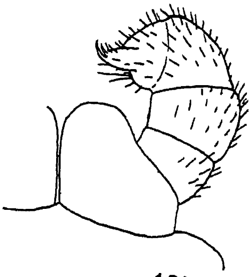

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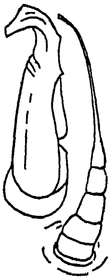

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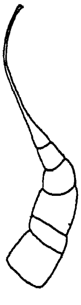

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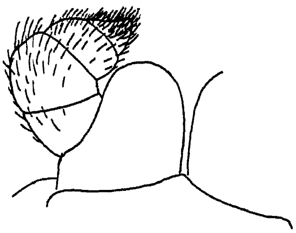

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Fig. 128. *Paroconus paurodesmus*, new species, head and collum, anterior view.
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Fig. 131. *Upsima princeps*, new species, caudal end of body, ventral view.
Fig. 132. Idem, left gonopods, subventral view.
Fig. 133. *Siphonophora praecisa*, new species, right gonopods, *in situ*, caudal view.
Fig. 134. Idem, right anterior gonopod, ectal view.
Fig. 135. Idem, right posterior gonopod, lateral view.
Fig. 136. *Zinazonium leeuweni*, new species, anterior gonopods, cephalic aspect.
Fig. 137. Idem, left posterior gonopod, caudal aspect.

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RESULTS OF THE ARCHBOLD EXPEDITIONS. NO. 52

THE MARSUPIAL GENUS *PHALANGER*

BY G. H. H. TATE

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Since the preparation of a first report on marsupials of New Guinea by Tate and Archbold (1937), much additional material, the fruits of the second and third Archbold New Guinea Expeditions, has come into the American Museum of Natural History. The collections of phalangers, thus markedly increased, provide such a quantity of new evidence relating to the genus *Phalanger* that an additional report is warranted. Mr. Richard Archbold is to be congratulated upon having assembled one of the largest collections of phalangers in the world.

Acknowledgment is gratefully made to the curators of mammals, Dr. W. H. Osgood at the Chicago Natural History Museum, Dr. Remington Kellogg of the United States National Museum, and Miss Barbara Lawrence of the Museum of Comparative Zoölogy, for the loan of specimens studied. It is a pleasure also to write of the courtesy and cooperation of authorities at the natural history museums at Genoa, Berlin, Leiden, London, and Paris, where in 1937 studies of material and photographs of some skulls of types were made.

Color names used in descriptions, if capitalized, are those of Ridgway (1912).

PHALANGER STORR

The first species of the genus *Phalanger* was described without technical name by Valentijn[1] between 1724 and 1726. "Color of the female as well as of the young said to be like that of a hare, with a longitudinal black line along the back; in males, however, which are always larger than females [the color] is variable but always rufescent on the belly and sometimes clear. . . . Among the white ones some appear to have the throat yellow; the eyes red in adults." The foregoing is quoted from Pallas (1766), who also alluded to Buffon's (1765) description of "le Phalanger," and named Valentijn's animal "*Didelphis orientalis*" (p. 59) or "*Didelphis opossum varietas orientalis*" (p. 62).

The use of *Phalanger* in the generic sense began with Storr (1780), who pointed out its relationship to *Didelphis* and associated with it the species *D. orientalis* Pallas. Thus by monotypy *orientalis* is the type species of *Phalanger*.

The second species to be made known was the very distinct *P. maculatus*, by Geoffroy St. Hilaire (1803). Additional species and races have since been added to the genus.

Didelphis molucca Kerr (1792), a name

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[1] Original not available for consultation.

proposed subsequently to *orientalis* Pallas but before *maculatus* Geoffroy, was accompanied by a description of a South American "four-eyed opossum." Reference was made to Brisson's work (1762), where allusion was made to *Philander orientalis* Seba (1734), *Philander amboinensis* (with spots above the eyes) "from Amboina," and *Philander maximus orientalis* Seba. As Brisson's names for species are not accepted in zoology, and as Kerr's *molucca* plainly referred to an American, not an East Indian, genus (*Metachirus* or *Metachirops*), the name *molucca* is considered to have no relationship to the genus *Phalanger*.

Synopses, discussions, or revisions of importance were published by Waterhouse, 1846, Gray, 1861, Jentink, 1885, Thomas, 1888, Schwarz, 1934, Tate and Archbold, 1937.

When dealing with characters involving age and degree of development in individual specimens of certain species of phalangers, the following standards and terminology have been followed:

Stage 1	Eruption of molars advanced to m^1 (pouch young)
Stage 2	Eruption of molars advanced to m^2
Stage 3	Eruption of molars advanced to m^3
Stage 4	Eruption of molars advanced to m^4
Stage 5	m^4 showing pronounced wear

In the parts of this paper devoted to notes on growth, these stages are correlated as far as possible with the development of color and pattern in the pelage, particularly in *P. maculatus*.

Three main groups of species are recognized within the genus *Phalanger:* the *orientalis* group, the *maculatus* group, and the *ursinus* group. The former *celebensis* group is merged with the *orientalis* group.

The *orientalis* group is the most generalized, though it includes a few slightly specialized members, and it has the widest distribution. Among its characteristics are weak sexual dichromatism in some races; development of pure white individuals in the male sex only; invariable lack of lateral expansion of the anterior nares; total lack of frontal "bulge" in skull; rarely, a diastema between i^3 and c (the species *celebensis* only). The total range of the group extends from Celebes and Timor, through New Guinea, to the remotest Solomons and northern Queensland.

The *maculatus* group is specialized in several ways: the males, unless white, have a definite spotted pattern (also weakly present in the race *ornatus* of the *orientalis* group), while, except on islands off the northwest coast of New Guinea, the females lack such spotting; pure white individuals occur in both sexes in the races *P. m. maculatus* and in females, at least, in *P. m. krämeri*, and the young go through a series of color changes; unexpanded anterior nares; unreduced i^3 approximated to canine; a pronounced frontal "bulge" in adults of both sexes. The range of the *maculatus* group includes Saleyer, Ceram and the southern Moluccas, New Guinea, north Queensland, the Bismarcks, the Admiralty Islands. It excludes Celebes and the Solomon Islands.

The *ursinus* group is also specialized, although in other ways: no color variations appear between the sexes or the young; white individuals are unknown; the anterior nares in adulthood become greatly expanded laterally; i^3 becomes exceptionally enlarged—in one race it is bicuspid; the canine is much reduced in proportional size; broadening of the frontal region may occur in age but there is no true frontal "bulge" as in the *maculatus* group. The range is restricted to the Celebes and Talaut.

FOUR NEW PHALANGERS

Phalanger orientalis peninsulae, new subspecies

TYPE: A.M.N.H. No. 108905, adult male; a skin with skull, in fair condition; Rocky Scrub, 30 miles north of Coen, north Queensland; collector, G. Neuhauser; field No. 509; June 26, 1938.

GENERAL CHARACTERS: Superficially resembles male specimens of *P. o. brevinasus* but is readily distinguished by much smaller teeth, which are as small as those of *P. o. microdon*, the adult male of which, though still unknown (but compare females), is thought equal to *mimicus*.

Description of Type: General color light grayish brown, the bases of the hairs whitish, the rump and legs paler, approximately Drab. Dorsal line from between ears to lumbar region fuscous. Underparts dirty white. Skull with general characters of the other races of *orientalis* but skull and teeth considerably smaller.

Measurements: Head and body (measured in field), 450 mm.; tail, 345; hind foot, "54"; ear, "37"; skull (measured in laboratory), condylobasal length, 81; zygomatic width, 50; mastoid width, 46; interorbital width, 15.2; width of braincase, 30; length of nasals, 32; greatest breadth of nasals, 15.2; outer width across paroccipital processes, 28.4; palatal length, 45; canine to m^4, 38.4; crown width of incisors: i^1, 2.4; i^2, 3; i^3, 1.1; p^4–m^4, 22.6; crown lengths and breadths: p^4, 4.7 by 3.9; m^1, 4.9 by 3.9; m^2, 4.4 by 4.2; m^3, 4.7 by 4.1; m^4, 4.4 by 4.

Remarks: In the lower jaw four minute obsolescent teeth appear between the chisel-shaped incisor and p_4. An anomaly shows in the left upper jaw; the milk p^4 is retained between the permanent p^4 and m^1. Dental measurements were made on the right toothrow.

Paratype: A second specimen, adult female, A.M.N.H. No. 108904, taken June 24, 1938, is distinguished from the male by its uniformity of dorsal color, which is much darker, near Benzo Brown, and has the white of the underparts restricted to the region anterior to the pouch. The belly hairs behind the pouch are also Benzo Brown. The hairs in both specimens are grizzled with whitish. This adult female is colored in marked contrast to those of *P. o. microdon* from south New Guinea, just across the Torres Strait. The latter are much redder "near Sayal Brown or Ochraceous Tawny." The white spot behind the ear seen in New Guinea material is undeveloped in either Australian specimen.

Remarks: This race seems to show the closest affinities with *microdon* (= *mimicus*) and with some of the island forms from northeast of New Guinea.

Phalanger celebensis pelengensis, new subspecies

Type: A.M.N.H. No. 107997, adult male; a skin with skull, both in good condition; Peleng Island, Celebes; collector, J. J. Menden; July 25, 1938.

General Characters: A very small race of *Phalanger*, closely resembling *P. celebensis*, but clear tawny brown instead of brownish gray, and with under parts yellow instead of white; resembles *P. c. rothschildi* in color and size but lacks the middorsal line.

Description of Skin: Hairs of back, head, flanks, base of tail, limbs, hands, and feet colored Sayal Brown, their normally concealed bases almost white. Throat and underside of neck near Cinnamon Buff; ventral parts Naples Yellow. No trace of dark dorsal stripe.

Description of Skull: Skull agrees closely with those of *celebensis* and *rothschildi* in most particulars. It is of approximately the same size and agrees closely in arrangement of the upper incisors and canines, i^3 being small and very slender with its root in virtual contact with that of c. It differs from *celebensis* only by the pointed (instead of rounded) form of the mastoid region, which last agrees substantially with the same structure in *P. c. rothschildi* and *P. orientalis*. The very minute third upper premolar, or its alveolus, can be perceived in all specimens. In the lower jaw there are three minute teeth between the big incisors and p_4.

Measurements: Head and body,[1] 364 mm.; tail,[1] 266; hind foot,[1] 47; skull, condylobasal length, 66.5; zygomatic width, 42; palatal length, 36; length of nasals, 25; greatest width of nasals, 9; interorbital width of temporal ridges, 10.5; mastoid width, 33; p^4–m^4, 19; crown length of i^2, 3; of i^3, 1.5; p^4, 3.8 by 3.3; m^1, 4.5 by 4; m^4, 3.5 by 3.3.

Remarks: Besides the type, the collector procured six males and seven females from the same locality.

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[1] Measured by the collector.

The race *pelengensis* is most nearly like *rothschildi* from Obi.

Phalanger atrimaculatus, new species

Type: A.M.N.H. No. 151813, adult male; a flat skin with skull, in good condition; Bernhard Camp, Idenburg River, 100 miles southwest of Hollandia, Netherlands New Guinea, 75 meters; collector, W. B. Richardson; May 5, 1939.

Description of Skin: Basal coloration a dull golden brown, near Chamois and Cinnamon Buff, dorsally and ventrally. Top of head, ears, neck, withers, and outside of forelimbs bright rufescent, near Tawny and Hay's Russet, becoming more saturate on hands and feet. Middle and hind back closely spotted with jet black—not chocolate or brownish black—which extends onto the thighs. Old (age stage 5, or with $\mathrm{m}\frac{4}{4}$ well worn).

Description of Skull: Very large, heavily ossified, and with exceptionally deep malar arch. Distinguished from the various races of *maculatus* by the extreme narrowing of the external pterygoid wings, the great broadening of the palate at the level of p^4, the fact that the masseteric ridge remains low on the jugal arch, and the presence of a small m^3.

Measurements: Skin (in the field), total length, 1204 mm.; tail, 610; hind foot (s.u.), 75; ear from crown, 27; skull, condylobasal length, 107 mm.; zygomatic breadth, 74; palatal length, 62; mastoid width, 60; outer width across p^4–^{4}, 39; toothrow, length, c–m^4, 56.5; p^4–m^4, 37; p^4, 7.6 by 6.3; m^4, 6.8 by 5; mandible, front of incisive alveolus to articular process, 89.

Remarks: *Phalanger atrimaculatus* is based upon the type and a second male, A.M.N.H. No. 79807, virtually identical in every respect except that it was collected at Keku, south of Madang, approximately 500 miles east of the type locality. This new spotted phalanger is here treated as a full species, partly because of seemingly valid anatomical peculiarities and partly because both known localities are in the heart of the distributional range of *P. m. maculatus*. It is, of course, possible that *maculatus* and *atrimaculatus* occupy separate ecological niches in the same areas and can thus be considered racially distinct, but such is hard to picture in the case of scandent forest animals like *Phalanger*.

Phalanger ursinus togianus, new subspecies

Type: A.M.N.H. No. 153377, young adult male; a flat skin with skull, in good condition; Malenge, Togian Islands; Gulf of Tomini, Celebes; collector, J. J. Menden; December 17, 1939.

General Characters: Externally very like *ursinus*. Distinguished by the unusual enlargement and bifid crown of the third upper incisor.

Description of Skin: Bases of hairs fuscous; tips tinted strongly with a golden brown overwash most pronounced about the face and sides of neck, fading to straw color on rump and sides of tail. Underparts grayish white with hair bases fuscous. Ears brown.

Skull with the characteristics of *ursinus* and *furvus* but with i^3 modified as stated above. The posterior one-third of the crown is separated as a distinct pointed cusp, by vertical grooves on the internal and external faces of the tooth.

Measurements: Head and body, 564 mm.; tail, 542; hind foot, 104; skull, condylobasal length, 93; zygomatic width, 60.5; interorbital width, 21; mastoid width, 46; length of nasals, 34; greatest width across nasals, 18.3; palatal length, 49; p^4–m^4, 31; p^4, 6.2 by 5.1; m^1, 6.7 by 5.4; m^4, 5.5 by 4.8.

Remarks: The tooth character used to distinguish the Togian Islands race is present in 10 out of the 12 males but in only five of the 11 females of the series. Thus there remains a minority of specimens which cannot be distinguished from typical *ursinus*. No sign of such division of i^3 is discernible in any of our 27 specimens from the mainland.

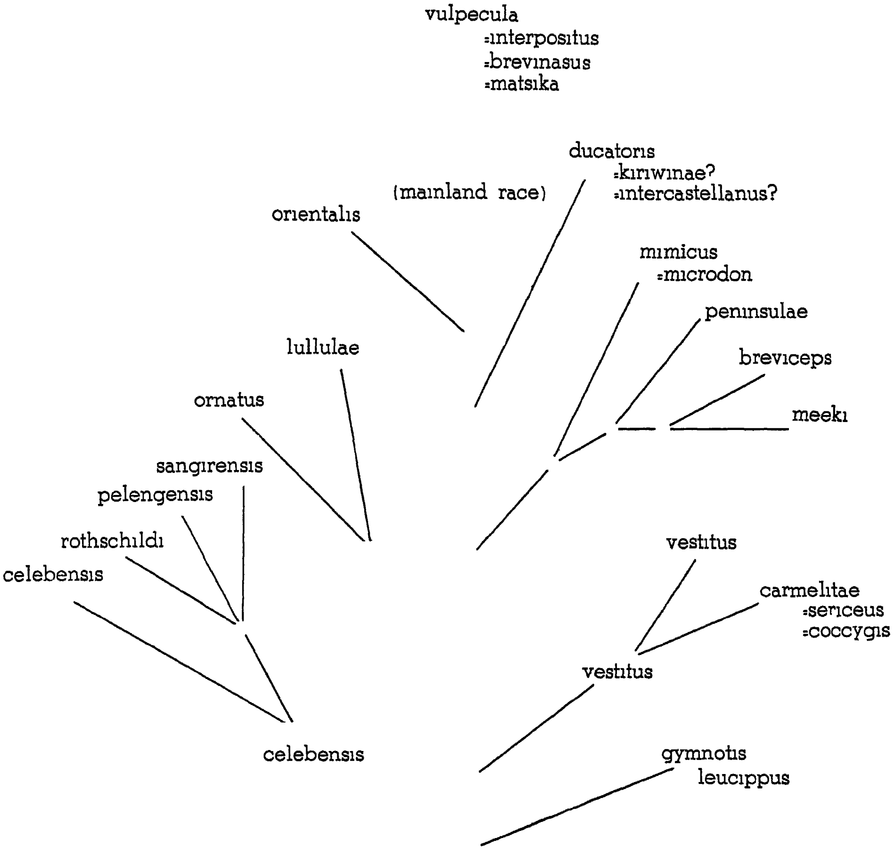

Fig. 1. Phylogenetic tree of the *Phalanger orientalis* group.

PHALANGER ORIENTALIS GROUP

The *Phalanger orientalis* group is here reclassified in the following manner:

1. *orientalis*
   a. From Amboina and Ceram, true *orientalis*
   b. From Moluccas, *ornatus* = ?*cavifrons* = ?*macrourus*
   c. Continental, eastern and Australian races
2. *gymnotis*, large-toothed species
   d. Mainland race, *leucippus*
   e. The questionably separable Aru Island race, *gymnotis*
   f. Wetar Island race showing kinship to true *orientalis*; probably the same as on Timor
3. *vestitus*, silky phalangers, with several ill-defined races
4. *celebensis*, least phalangers and races, found on Celebes, Peleng, Obi, and Sanghir

Phalanger orientalis is distinguished from the three other members of the group chiefly by the lack of the features which characterize them. On the positive side, most of its races exhibit some degree of sexual dichromatism (gray males, brown females); the juvenals are usually reddish; white males appear only in this species (the races *P. o. orientalis* and *P. o. ducatoris*); the race *P. o. ornatus* is often spotted; p^4_4 are not exceptionally enlarged, as in *gymnotis;* c is never so reduced nor is the skull so small as in *celebensis;* the hair never attains the long, lax condition of *vestitus.* The range of the species is shown in figure 8.

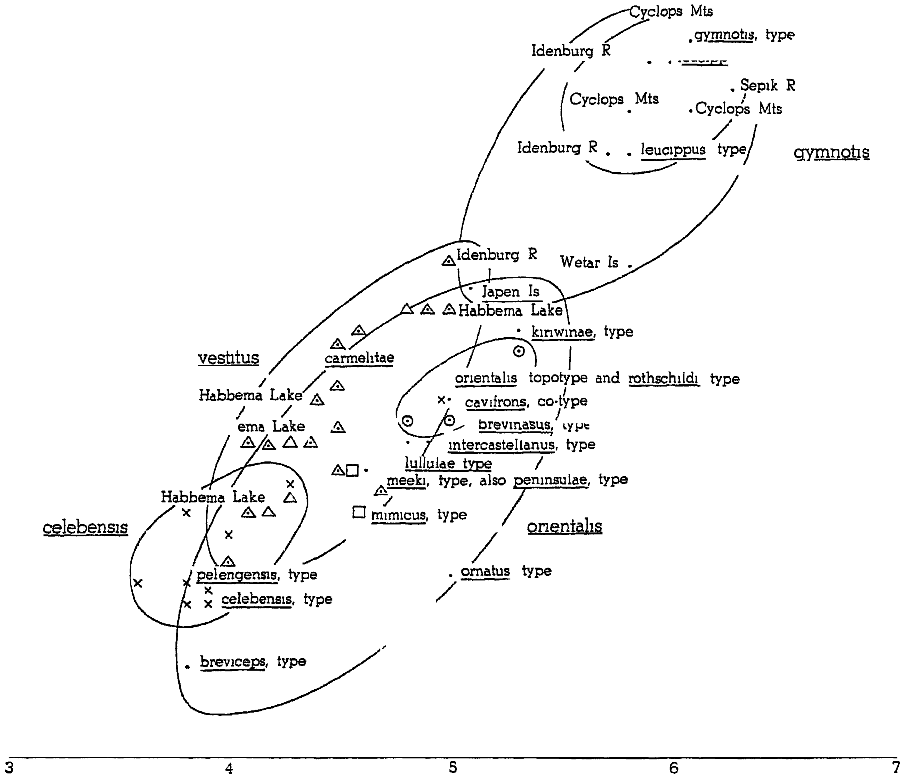

Fig. 2. The crown dimensions (in mm.) of p^4 in males of *P. orientalis* and close allies. Vertical represents width of tooth; horizontal, its length.

Phalanger gymnotis is a large, strong species totally devoid of color distinction between the sexes or the adults and young; p^4_4 are exceptionally large and considerably displaced outward from the toothrow.

Phalanger vestitus, the mountain phalanger, includes the silky, long-haired, chocolate brown forms of the New Guinea mainland.

Phalanger celebensis comprises several races of very small animals in which, though the sexes are colored alike, the young are usually reddish. In all, i^3 is distinctly separated from c.

Phalanger orientalis

The classification of the phalangers of this species is the most complex of all. It appears that the mainland of New Guinea contains two relatively homogeneous races of the species: *vulpecula* = ?*interpositus* = *brevinasus* = *matsika*, a large-toothed form occupying most of New Guinea with the exception of southern New Guinea (including the basins of the Fly and Digul rivers), and *mimicus* = ?*microdon*, a small-toothed form, confined, as far as is known, to southern Netherlands New Guinea and the Fly River area. Thus the one race replaces the other geographically. The new race, *peninsulae*, of north Queensland, is an offshoot of the phylogenetic line leading to *microdon*.

The large-toothed New Guinea mainland form, and probably *microdon* too, are sexually dichromatic; the males are essentially gray, the females essentially brown. That condition may have been developed from a monochromatic ancestry, because on the island groups at both ends of New Guinea races exist in which sexual dichromatism similar to that on the mainland has not been observed. Moreover, *P. gymnotis*, the nearest related full species on the mainland, is strictly monochromatic.

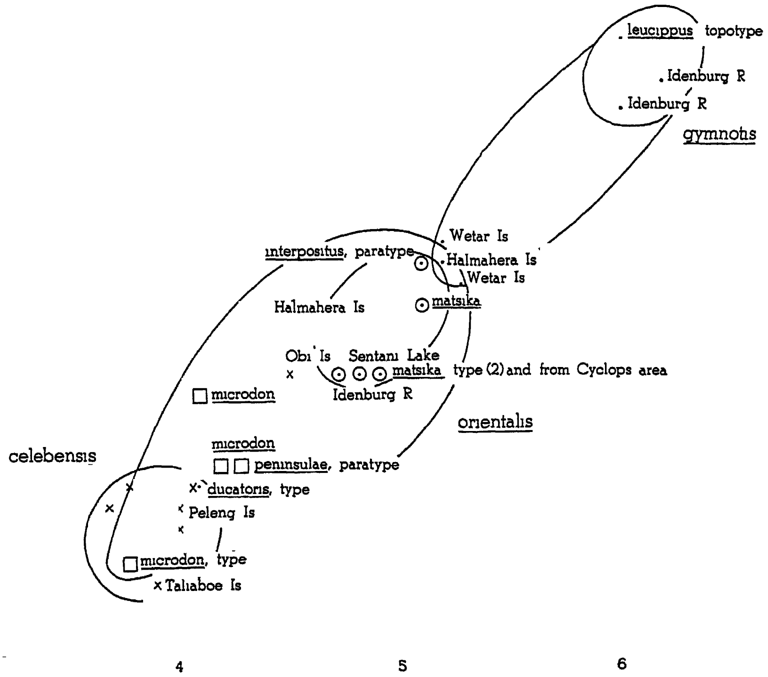

Fig. 3. The crown dimensions (in mm.) of p^4 in females of *P. orientalis* and close allies. Vertical represents width of tooth; horizontal, its length.

West of New Guinea two poorly known races exist: the typical race of *orientalis* of Amboina and Ceram, in which frequently white males occur; and *ornatus* = ?*cavifrons*, found in the Moluccas, the only spotted member of the striped phalangers.

East of New Guinea, on the Bismarck, Solomon, Trobriand, Louisiade, and D'Entrecasteaux groups of islands there exist a number of weakly separable, named races, none of which exhibits strong sexual dichromatism, but one of which shows strong polychromatism between different individuals.

Possible phylogenetic relationships of the races of *P. orientalis* are indicated in the accompanying phyletic tree (fig.1), constructed after a close study of the characteristics of specimens and the literature.

The interrelationships of the species

and races of the *P. orientalis* group, as well as the very slight differences between the sexes, are strikingly illustrated by plotting the crown dimensions of the last upper premolar (figs. 2 and 3). The relatively large size of that tooth in *P. gymnotis* and its very small size in *celebensis* and the peculiar *P. o. breviceps* (type specimen) are emphasized, as well as the generally broader, shorter form of the tooth in *vestitus* when compared with the races of *orientalis*.

In the same way, absolute and proportional differences in the hinder part of the skull in the several species are demonstrated by the ratio graphed in figure 4. In this instance the difference of proportion is most noticeable between *orientalis* and *gymnotis;* in *celebensis* it is set off sharply from *orientalis* by size only.

Owing to the limited number of specimens available for plotting in figures 2 and 4, the lines drawn to enclose the races and species assume only sub-elliptical outlines. Were ideally large numbers of specimens available, nearly perfect ellipses would be drawn to enclose them; the long axes would represent norms and the lateral expanses, standard deviations from the norms.

The positions of many of the type specimens of species and races in relation to the whole picture are indicated in the diagrams. The geographical names indicate other specimens from the places named, which may be hundreds of miles from the type localities. The distinctions brought out in these diagrams are founded upon size and structure. Only incidentally, as in the cases of *P. celebensis* and *gymnotis*, is distributional significance shown also.

The symbols used in figures 2–4 are alike:

Dots	*P. gymnotis*, with *leucippus;* also anomalous material from Wetar Island, and members of the races of *P. o. ornatus* and *P. o. breviceps*
Dots in circles	Mainland *P. orientalis* of the race *vulpecula*
Squares	The south New Guinea race, *P. o. mimicus*, with *microdon*, and the allied race of *peninsulae*
Dots in triangles	*P. vestitus*, with *carmelitae* and *coccygis*
Crosses	*P. celebensis* and relatives

The lesser ellipsoid containing circles, within the greater ellipsoid which represents *P. orientalis*, full species, typifies the form *vulpecula* on the New Guinea mainland north of the Central Range.

Shift of the long axes out of the same straight line may be taken to mean different proportions in the structures plotted.

Phalanger orientalis orientalis (Pallas)

Didelphis orientalis PALLAS, 1766, Miscellanea zoologica, p. 61.

? *Didelphis quoy* GAIMARD, 1824, Bull. Sci. Nat., Paris, vol. 1, p. 271; QUOY AND GAIMARD, Voyage Uranie, Zool., p. 58.

? *Cuscus amboinensis* LACÉPÈDE, 1801, Mem. Inst. Paris, vol. 3, p. 491.

Establishment of the identity of true *orientalis* is of great importance in work on the systematics of the group. Pallas (1766) applied the name *orientalis* to the animal from Amboina described by Valentijn (1724–1726), so the striped phalangers from Amboina are without much doubt referable to true *orientalis*. Although no actual specimen of true *orientalis* is contained in our collection, a photograph of the skull of an old albinistic male, B.M. No. 83.3.24.7, from Amboina, provides evidence of the skull characters of the typical race. In it the frontal trough is singularly broad and deep (the greatest breadth, 21 mm.), and the supratemporal ridges come abruptly together behind to form a pronounced sagittal crest. The zygomata are well broadened, exceeding the mastoid breadth (68/53). The nasals are relatively short, not sharply pointed anteriorly. The fourth premolars are not enlarged and are but little twisted, or displaced outwards from the row. The crown widths of the upper incisors are: i^1, 2.6 mm.; i^2, 2.7; i^3, 1.1. These dimensions require interpretation: i^1, a chisel-like incisor growing from a consistent pulp, becomes heavier and thicker as the animal ages; i^2, on the other hand, begins as a rounded (in section), chisel-like crown carried on a relatively slender permanent root. Thus, as the crown is worn down to the root the tooth becomes *smaller* in section. So, when animals are young,

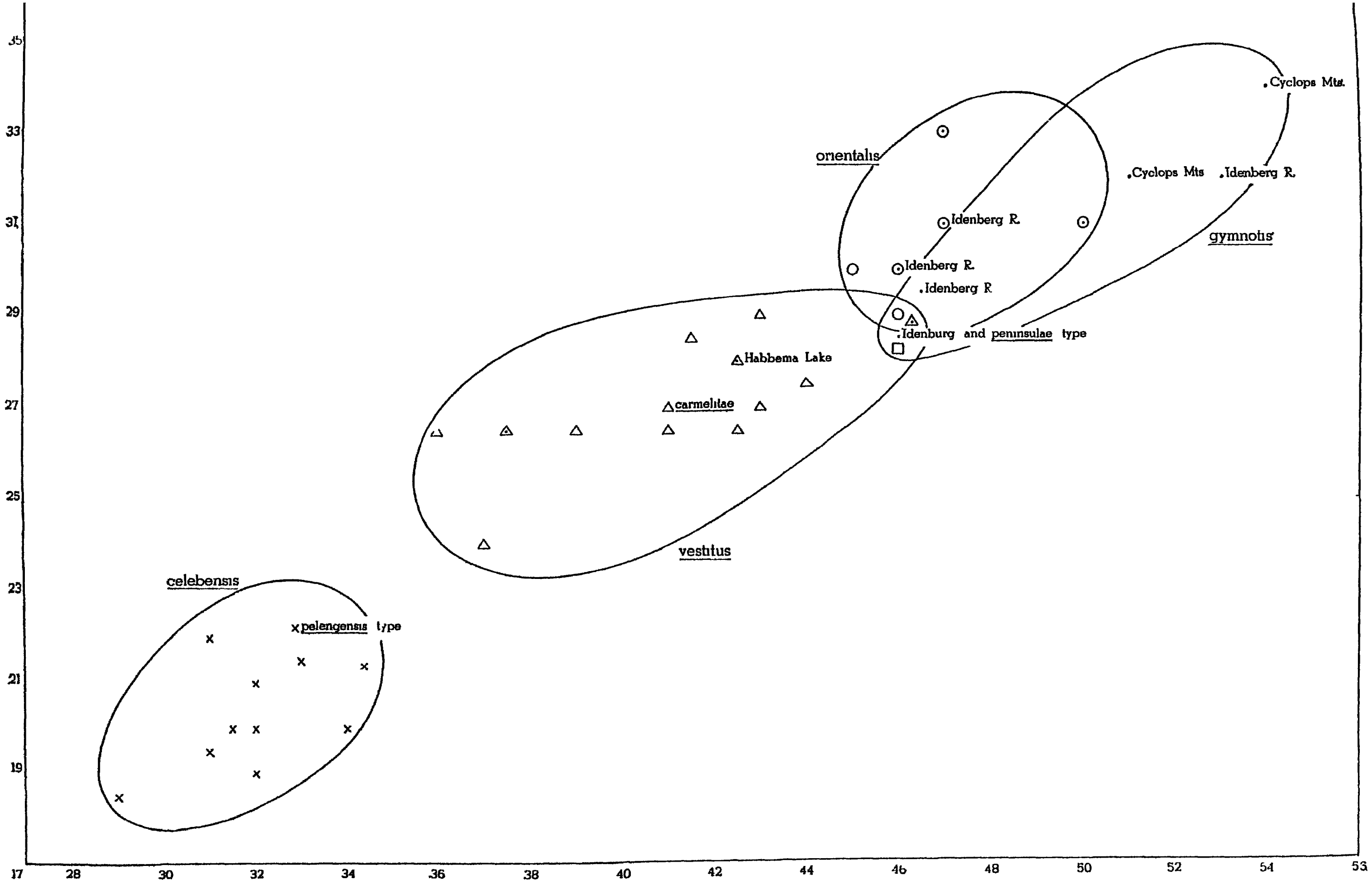

Fig. 4. Ratio of outer width across paroccipital processes (vertical) to mastoid width (horizontal) in millimeters in males of *P orientalis* and allies.

the width of i^1 may be less than that of i^2; when old, the reverse is often seen.

Jentink (1885, pp. 100–104) dealt almost wholly with specimens from the general neighborhood of the Moluccas. He pointed out the fact of partial or total obsolescence of the longitudinal dorsal line in some animals. The "brown" color mentioned by him may well be due to fading of an original gray.

Of the specimens described by Jentink from Amboina and Ceram (I take them together) most males were white and most females were "brown." One female was "reddish brown." Among the white males one had a "brown collar" and one showed a trace of the dorsal line. Many others were juvenals which showed "brownish silvery" or gray body color. The dimensions of none were given. To summarize, we may consider that in typical *orientalis* adults nearly all the males are white or grayish white and the females are either gray or gray brown.

Specimens described from Buru and Sula Besi, west of Ceram, seem to agree with the form from Ceram. White males occur. The same is true of specimens from Goram, east of Ceram.

It is my opinion that *Phalanger quoyi*, with well-defined dorsal stripe, is a member of the *orientalis* group, not of the *maculatus* group, in which it has been synonymized by authors. The mounted specimen, Paris No. 209, with skull in the skin, probably a female, is marked as from Waigeu (Gaimard, 1824, p. 271, states that it was said to be from Amboina, but Quoy and Gaimard, 1824, p. 59, pl. 6, state that it was from Waigeu). The present color (1937) of the skin is faded gray brown; underparts buffy; a slightly reddish area behind the eye; the whitish of the underparts comes up to a line joining the angle of the mouth with the ear. Head and body, 400 mm.; tail, 310; hind foot (s.u.), 52. Widths of incisor crowns, i^1, 2 mm.; i^2, 3.1; i^3, 1.7.

The plate in Quoy and Gaimard (1824) depicts a tawny-colored animal with small spots of slightly deeper brown. These do not show at all in the type today. Whether the specimen is referable to true *orientalis* or to the race *ornatus* is still uncertain.

Measurements of *P. orientalis* are shown in table 1.

Phalanger orientalis ornatus (Gray)

? *Phalanger macrourus* Lesson and Garnot, 1826, Voyage Coquille, p. 156.

? *Phalangista cavifrons* Temminck, 1827, Mammalogie, vol. 1, p. 17.

Cuscus ornatus Gray, 1860, Proc. Zool. Soc. London, p. 1.

Phalanger ornatus was held by Jentink to be fully synonymous with *orientalis* of Amboina and Ceram. But certain obvious differences between the two can be noted. In *ornatus*, albinistic males, so usual in populations of *orientalis*, either do not occur or must be rare. Again, spotting on the brownish gray or buffy brown basal coat color, common in *ornatus*, is unknown in true *orientalis*, except the race *lullulae*. Finally, the skull of *ornatus* differs from that of *orientalis* by the pinched-in muzzle and by several other features, shown beyond.

The type specimen, an adult male, B.M. No. 60.1.10.17 (skull, B.M. No. 60.1.10.18) was collected by A. R. Wallace at Batjan Island. A photograph of the skull shows considerable enlargement of both i^1 and i^2, their crown widths, respectively, 2.2 and 3.2 mm., indicating greater massiveness of both teeth than is the case in true *orientalis*. Furthermore, the frontal trough is carried much farther back between the temporal ridges, and the nasals, pointed in front, extend to the back of the premaxillae.

In a very old specimen (M.C.Z. No. 7000), female (to judge from the lack of heavy scales beneath the proximal end of the bare part of the tail), from Galela, Halmahera, the cranial characters of the type are substantially reproduced. Of the upper incisors, i^1 is worn down almost to its root (width only 2.5 mm.). In both specimens the minute p^3 is present. The skin appears faded; its general dorsal color approaches Raw Sienna, relieved by a slightly darker dorsal line and a few scattered paler spots. The Raw Sienna fades to Cream Buff on rump and thighs. Color of underparts white.

A third specimen of *ornatus* examined, Genoa C.E. No. 10315, female, also from Halmahera, is slightly more reddish than the foregoing. The crown widths of the incisors are: i^1, 1.9; i^2, 3.1, indicating greater youth.

Phalanger macrourus Lesson and Garnot was described " . . . body gray with scattered brown spots . . . female . . . the large-tailed cuscus is only 12 inches 8 lines from nose to base of tail, and this has 17 inches . . . covered with a dense pelage, exceeded by many silky black hairs. . .instead of three false molars there are but two. . .ears more prominent. . .equally haired inside and out. . .hair of ears white, also the throat and underside of neck. . .belly and inside of thighs whitish." This description is accompanied by a badly colored plate in which the tail is drawn disproportionately thick. *P. macrourus* was formerly placed in the synonymy of *P. maculatus*.

Phalanger cavifrons Temminck, from "Moluccas," is today represented in the Leiden Museum by a skull only (Cat. No. M-3). The mandible associated with the skull does not belong to it. The skull is juvenal, with m^2 newly erupted. It may be referable either to *orientalis* or *ornatus*, or it may be from the New Guinea mainland (which was once loosely included in "the Moluccas").

The *ornatus*-like phalangers are mentioned specifically from Halmahera, Batjan, Ternate, and Morotai.

Phalanger orientalis vulpecula (Förster)

Pseudochirus vulpecula FÖRSTER, 1911, Zool. Ann., ser. 2, vol. 42, p. 179.

Phalanger orientalis interpositus STEIN, 1933, Zeitsber. f. Saugetierk., vol. 8, p. 90.

Phalanger brevinasus TATE AND ARCHBOLD, 1935, Amer. Mus. Novitates, no. 810, p. 5 (males).

Phalanger matsika TATE AND ARCHBOLD, 1935, *ibid.*, no. 810, p. 7 (females).

MATERIAL EXAMINED: The original series of *brevinasus* and *matsika;* several more specimens from the type locality, including fully adult females; a series of eight specimens from the neighborhood of the Cyclops Mountains, north coast of New Guinea; several males and one female from the middle Idenburg River; a female paratype of *interpositus;* Stein's material from Japen Island.

The principal characters of *vulpecula* are the much greater size of males than females; the gray color of the male pelage contrasted with the coppery brown of the fur of the females; and the strongly reddish brown color of juvenal males and females. These characters are probably shared with *mimicus* = *microdon*, of which we have no adult males. *P. o. vulpecula* has decidedly larger teeth than *P. o. microdon.*

Two young seem to be born at a time; each of two females collected near Port Moresby carried two pouch young. The young were much grayer than other juvenals no longer living in the pouch, but nevertheless showed indications of reddish. The pelage was very short, as is usual in pouch young. The blackish dorsal stripe was already evident. One pouch contained a male and a female, the female with proportionately longer tail. The ratio of tail to head and body: female, 228/232; male, 212/237. The type of *matsika* had but one pouch embryo; A.M.N.H. No. 109443 from Sentani Lake had three; the paratype of *interpositus*, Stein's field No. 98, had two. It is possible that this multiparous habit (compare *maculatus*) has some value in classification.

Stein's series from Japen (taken March, 1931) is also sexually dichromatic. Males are gray with white underparts, females brownish gray, underparts gray white. In the young stages the males are gray, the females reddish.

Specimens from Misol, Salawatti, Jobi, and Soek, as well as from Kei, seem to be referable to the New Guinea mainland form.

Phalanger orientalis vulpecula of the Huon Peninsula was described by Förster (1911) as a reddish juvenal ("m^3 not erupted") under the name *Pseudochirus vulpecula.* He wrote of the distinctive *Phalanger* character: "terminal 115 mm. of tail bare." The skull dimensions given were: basal length, 50 mm.; zygomatic breadth, 32 mm. All this indicates *Phalanger* and differs from *Pseudochirus.* Thomas (1922), using the name "*orientalis*" for specimens from the Rawlinson Mountains, wrote about the "well-known red juvenal state." Thus it seems reasonable to conclude that the Huon Peninsula animals, *vulpecula,* and the widely dispersed *P. o. brevinasus*, whose young also have red pelage, are synonymous.

Measurements appear in table 2.

Phalanger orientalis mimicus Thomas

Phalanger mimicus THOMAS, 1922, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 680.

Phalanger microdon TATE AND ARCHBOLD, 1935, Amer. Mus. Novitates, no. 810, p. 8; 1937, Bull. Amer. Mus. Nat. Hist., vol. 73, p. 378.

MATERIAL EXAMINED: The type of *mimicus;* the original series of *microdon* from Dogwa; two juvenal specimens from the Palmer River, upper Fly River. Also Genoa C.E. No. 5401, adult female from the Fly River, collected by D'Albertis, concerning which is written in my notes "skull generally as in *brevinasus* but rather smaller and shorter; the individual teeth much smaller. . .p^4–m^4, 21 mm.; m^{1-3}, 13.8." (Compare Tate and Archbold, 1937, p. 444.)

In Perth Museum (Western Australia) are two juvenal specimens, M-513, male, and M-514, female, collected by Stalker at Kei. They are small reddish phalangers possibly referable to *microdon*.

Specimens from Aru alluded to by Jentink (1885) are probably referable to *mimicus*, since that island seems to have been connected in the recent past with south New Guinea.

The range of this race is not known to overlap that of *P. o. vulpecula* found north of the main mountain range. *P. o. mimicus*, including *microdon*, inhabits the whole of southern New Guinea from the Torres Strait to the upper Fly River and westward along the narrow coastal strip of Netherlands New Guinea at least as far as the Mimika River. Eastward the limits of its range are not known. At Port Moresby its place is taken by *brevinasus* = *vulpecula*.

Phalanger orientalis peninsulae Tate

(See description, p. 2.)

Phalanger orientalis NORTHEAST OF NEW GUINEA

Several of these phalangers, often collectively named *P. o. breviceps*, have at various times been given subspecific names by Thomas:

P. o. intercastellanus	Fergusson Island, D'Entrecasteaux
P. o. meeki	Tegula Island, Louisiades
P. o. lullulae	Woodlark Island, Trobriands
P. o. kiriwinae	Kiriwina, Trobriands
P. o. ducatoris	Duke of York Island, Bismarcks
P. o. breviceps	San Cristobal, Solomons

Phalangers of the island groups off the eastern tip of New Guinea may first be considered. Those islands are nearer the mainland, and their comparatively shallow under-water connections are all with New Guinea.

With the exception of *lullulae* from Woodlark Island, the most remote of the Trobriand group, these races are gray or brownish, there being little difference in color between males and females. The males are generally a little paler gray. The females apparently never develop the reddish brown color usual in the New Guinea race *vulpecula*.

Only three named races are involved: *kiriwinae* from Kiriwina, western Trobriand Islands; *intercastellanus* from Fergusson Island, D'Entrecasteaux group; and *meeki* from Misima (= St. Aignan) Island, the Louisiades Archipelago. A few years ago, after examining the types of all, I concluded that the large skulls of *intercastellanus* and *kiriwinae* showed closer relationship to those of the Bismarcks and New Guinea animals, and that the short-faced skull of the smaller *meeki* resembled typical *breviceps* of San Cristobal, the most easterly of the Solomon Islands. Possibly *kiriwinae*, *intercastellanus*, and *ducatoris* should be synonymized.

The peculiar Woodlark Island race *lullulae* exhibits analogies with *ornatus* on the Moluccas, *west* of New Guinea; it is spotted with pale buff on gray. The pelage is short and rather stiff; the ventral color white to the roots. The skull is somewhat pear shaped. Molars small.

We may consider next the phalangers of the Bismarcks and Solomons. The populations of striped phalangers taken successively from Long and Ruk Islands, through New Britain, New Ireland, the groups of islands north and east of it (Tabar, Lihir, Tanga, and Nissan), and from Bougainville southeast through the twin chains of the Solomons show the following peculiarities:

1. Those of Long Island and Ruk, New Britain, Duke of York, New Ireland, Lihir, and Tabar are large, heavily built animals, the males drab gray, females darker brownish gray, with strong, elongate, narrow skulls, and large teeth. To this group *ducatoris* probably belong the large, broad-skulled phalangers *kiriwinae* of Kiriwina (Trobriands) and *intercastellanus* of Fergusson (D'Entrecasteaux). If *orientalis* is represented on the Admiralty Islands and St. Matthias it may be expected to conform to this general type.

2. White males occur on Long Island and (?) New Britain; they are analogous to the white males in *P. o. orientalis* of Ceram and Amboina.

3. On Tanga, off New Ireland, and Nissan, between New Ireland and Bougainville, unusually small animals occur, in which the skull is short and broad and the teeth sharply reduced in size. The extreme in this respect in our collection is A.M.N.H. No. 79793, adult female, from Nissan, in which the length of p^4–m^4 is only 19.5 mm.

4. The average body and skull sizes in the population of gray phalangers on Bougainville of the Solomons are larger than those of the Nissan race, though they do not attain that of *ducatoris* of the Bismarcks. The Bougainville race also contains individuals of slightly smaller size, with which the phalanger populations on the remaining islands of the Solomons eastward agree closely.

5. Elongation of the skulls of the race *ducatoris* (fig. 5) is seemingly a function of age. It is associated with great development of the supratemporal, sagittal, and lamboidal crests. Slightly younger adults, though with fully developed dentition, have the skull yet unlengthened, with the ratio, zygomatic breadth : basi-occipital length, from 65 to 67 per cent. In old specimens of either sex that ratio varies from 59 to 62 per cent. The seeming lack of elongation of the skull in adults of the phalangers of the Solomon Islands may either be real and correlated with the smaller teeth, or it may lack significance because of our inadequate age series. It is to be noted that in certain animals from Bougainville, Mono Ganonga, and Malaita, the said ratio may be as low as 60 per cent.

6. On the Solomons, besides gray phalangers, there occur specimens with silky pelage colored blackish brown or chocolate brown. Their skulls and teeth are indistinguishable from those of the gray phalangers. The distribution of these animals through the southern Solomons arc—we have them from Bougainville, Rubiana, Ganonga, Rendova, Guadalcanal, Komanchi, and Malaita—may be only apparently important, as we have but a limited collection of phalangers from the northern arc of islands, none at all from Choiseul or Ysabel, and only one (gray) from Molakobi which lies between them. Whether or not these chocolate-colored animals conform to a geographical pattern of distribution within a part of the Solomons group, they are certainly restricted to those islands when taken together. Their dark color, silky fur, and the sharp defining line between dorsal and ventral color (clear buffy white) offer a striking analogy to the New Guinea mountain-inhabiting phalangers, *P. vestitus* and allies. The teeth, however, are much smaller.

7. The color of juvenal animals from the eastern and northeastern islands is as yet poorly determined. From Bougainville (Buin) comes a juvenal specimen in red pelage that well matches that of young *brevinasus* of New Guinea. From Ganonga we have a late pouch-embryo in the characteristically short coat; its slightly reddish gray color closely matches that of pouch young of *brevinasus*. On the other hand, from the north coast of Bougainville a juvenal individual, apparently the offspring of the chocolate-colored variety, has long, lax, blackish brown fur. A juvenal female of *intercastellanus* from Goodenough Island has the customary red brown coloring of the majority of the races of *orientalis*. Yet an only slightly larger subadult male

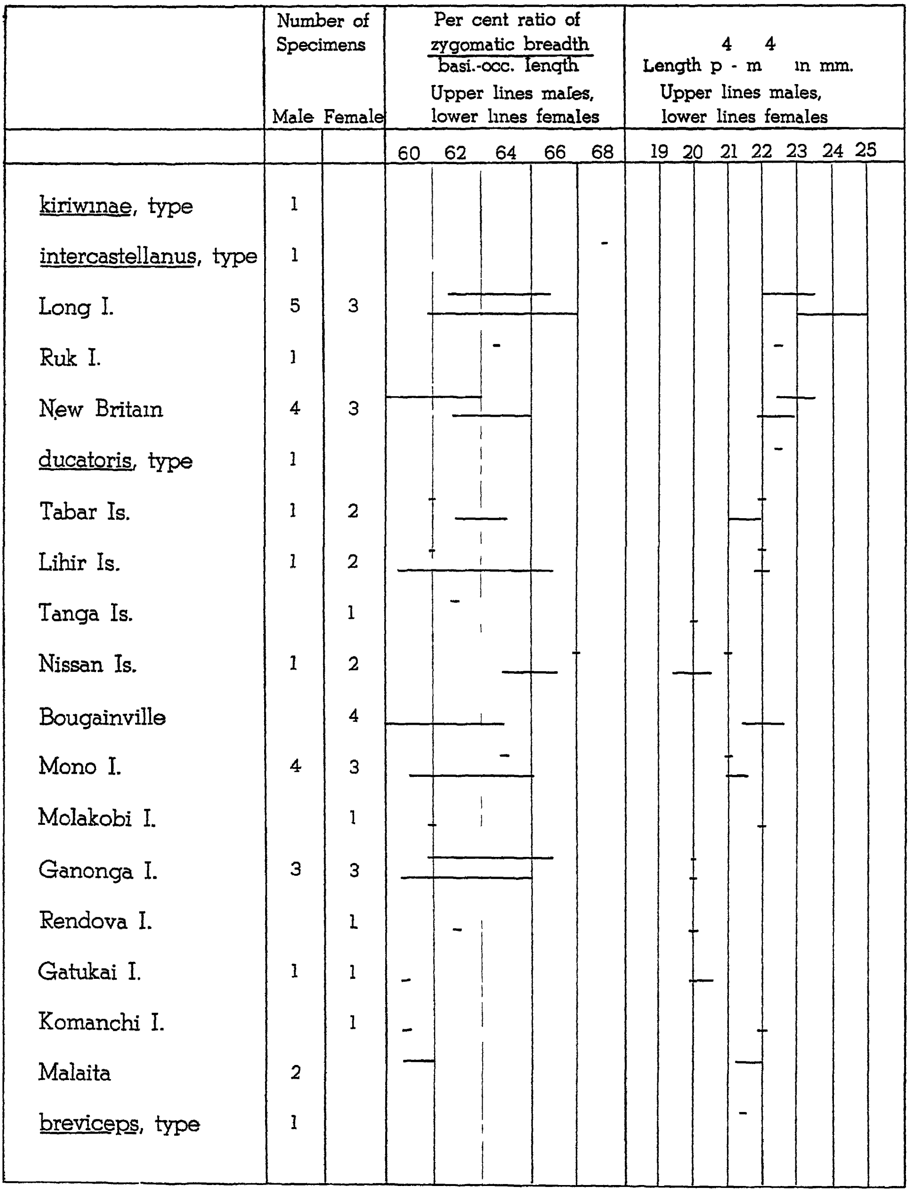

Fig. 5. Comparison of forms of *P. orientalis* on the islands northeast of New Guinea.

of *meeki* from Tagula Island, Louisiades, is already completely gray.

It does not seem possible even yet to draw sound conclusions from the facts about these island forms so far presented. Most appear to be in a formative or transitional stage, which, if they could be bred and watched under laboratory conditions, might be highly instructive.

Phalanger gymnotis (Peters and Doria)

Phalangista gymnotis Peters and Doria, 1875, Ann. Mus. Civ. Genova, vol. 7, p. 543.

Phalanger leucippus Thomas, 1898, *ibid.*, ser. 2, vol. 19, pp. 7–8.

Material Examined: Port Moresby area: six (previously reported, from 2000–7000 feet), two (Astrolabe Range); upper Fly River (head waters): one (3000 feet); upper Idenburg River: 10 (200 feet); Cyclops area: five (1–1000 feet); lower Sepik River (borrowed): one (100 feet?).

A further record was made by Jentink in 1911 of one specimen from Ryen Island and two from Alkmaar, up the Noord River.

The total material indicates a vertical range for this conspicuous species between sea level and 7000 feet. It appears to be just as abundant north of the Central Range as south of it, so a generalized pattern of distribution for it is indicated (fig. 9). Its extension to Aru Island may well have been accomplished during the glacial period, when Aru was connected to the mainland somewhere near de Jorg's Point.

The great stability in this species is indicated by the relatively good series from widely dispersed localities. The commonly present "ticked," shining, slightly curled gray pelage is varied in only two specimens (males from Idenburg River) in the direction of a flatter, more neutral gray. The black dorsal line is invariably strongly defined. The underparts vary slightly from light gray to grayish white. There is often a chest patch in which the hairs are white to the roots. In an old female near-topotype (of *leucippus*) considerable chestnut appears on throat and chin (possibly a food stain), reminiscent of the appearance of certain *Rattus* of that region. As table 3 shows, there appears a slight though not uniform increase in size of m^4 in specimens from the north center of the island, as compared with those from the southeast. The *gymnotis* of Aru falls in with the former. Our one specimen (male) from Mount Karik (3000 feet), head waters of the Fly River, has no skull. Not a single specimen of our series lacks the small p^3.

Growth stages in *P. gymnotis* cannot be shown; we have but two young specimens, a stage-1 female, with mp_4^4 still in place, and a stage-3 male in which p^4 is fully erupted. A series of measurements of *P. gymnotis* appears in table 3.

The type of *P. gymnotis* is a mounted male skin, Genoa C.E. No. 1545, and mounted skeleton, C.E. No. 3966. Of general size of *leucippus* but the pelage appearing shorter (5–7 mm.). Ears not concealed. The customary heavy scaling is seen in the tail as in *leucippus*. In the skull, great expansion of the zygomata and extreme enlargement of p^4, coupled with its outward displacement and rotation, are noteworthy. "Rostrum short and massive; maxillo-premaxillary suture reaching nasals at middle; frontal trough deep; sagittal crest well-developed, attaining elevation of 4.5 mm.; paroccipital processes short and blunt, their width apart, 32.5 mm.; epipubic bones 30 mm."

The cotypes of *P. leucippus* are marked "type," one at Genoa, C.E. No. 10454, the other at London, B.M. No. 97.8.7.88. Both are adult males, both from "Parte montuosa del Vanapa," collected by Loria. No altitude was recorded.

The chief difference not attributable to age appears in the length of the pelage (13–17 mm.), and even that difference may be accounted for by seasonal wear and molt. Both animals are somewhat younger and smaller than the type of *gymnotis*.

Phalanger gymnotis of Aru, collected by Beccari, and *P. leucippus* of the mainland have long been considered conspecific. Study of the type skulls and of a further extensive series of specimens confirms this view. Any doubts concerning the actual place of origin of the unique specimen of *gymnotis* are allayed by Beccari's unequivocal note (1924), in which he writes of the capture of the type on May 5: "The natives state that this animal is terrestrial, that it does not climb trees, and that they call it 'guannal cafa.' They say that the females have the same color as the males."

In connection with Beccari's note that *P. gymnotis* is terrestrial, it may be remarked that the specimens taken by the writer were found in rocky places—in forest at the base of rock outcrops. But also two were shot at night by jacklight when they were 20 feet up trees.

The American Museum series from Wetar Island were assumed earlier (Tate and Archbold, 1937) to be typical of *P. o. orientalis*. Later study of a topotype of *orientalis* in the British Museum collection showed this assumption to be wrong. The unusually large size of p^4_4 in the Wetar series makes it probable that affinity with *gymnotis* exists, and for the present the Wetar animals will be so regarded. *P. orientalis* from Timor, according to Jentink (1885), lack the dorsal line. Their colors are light brown or whitish, with underparts white. Albinistic males are said to occur however, as in true *orientalis*. Close relationship between the striped cuscuses of Timor and Wetar may be expected.

Phalanger vestitus

The silky phalangers were treated (Tate and Archbold, 1937) under the name *Phalanger sericeus*, as *P. vestitus* (Milne Edwards), 1877, was then uncertainly identifiable from the literature. More recently the type specimens of *vestitus*, *sericeus*, *coccygis*, and *carmelitae*—all proving to be silky phalangers—have been studied and their skulls have been photographed. *P. vestitus*, which is an older name than *P. sericeus* Thomas, 1907, must be employed for the silky species instead. *P. carmelitae*, which was placed by us in the *orientalis* group, has also proved, on examination of the type, to be a close relative of *vestitus*.

Much new material referable to this group has resulted from the work of the second and third Archbold New Guinea Expeditions; part of this is from the Central Range, east of Port Moresby, and from the region about Lake Habbema and Mount Wilhelmina in central Netherlands New Guinea.

MATERIAL EXAMINED: Huon Peninsula (*coccygis*): six specimens previously reported (none additional); Port Moresby area: six specimens from Kagi, 5000 feet, foot of Mount Albert Edward, in addition to six *sericeus* and two *carmelitae* previously reported; Mount Wilhelmina area: 22 specimens (10,000 to 11,000 feet); Weyland Mountains: two specimens collected by Klein. The types of *vestitus*, *carmelitae*, *sericeus*, and *coccygis*.

The type of *Cuscus vestitus* Milne Edwards was described as having long, silky pelage, colored glossy black, with sides more grayish, ". . .underparts pure white. The single specimen is young, for its replacement molar is still developing. It measures 520 mm. from muzzle to tip of tail, the latter having 240 mm. . . ."

The type specimen of *vestitus* from Karons Mountains, Tamru Mountains, northern Vogelkop, which was placed by both Jentink and Thomas in the synonymy of *P. orientalis*, is a juvenal male, the skin mounted and carrying the numbers 289 (204A), 1477, and the date 1877. Pelage soft and silky, with well-defined dorsal stripe from head to lumbar region, stripe widest at the withers, 25 mm. Present general color dark brownish gray, underparts creamy white, with a central patch of pure white beneath neck and chest. None of the white hairs with gray bases.

The back of the skull is sliced off. The first and second molars only have been erupted (stage 2), and the milk premolars remain unshed. One side of the face has been cut away to show the permanent upper fourth premolar, which is only partly developed. The pointed i^1 and c are but partly erupted; i^2 is very large and well worn; i^3 is small and appears slightly worn. Even in youth the skull shows the pear-shaped outline characteristic of *sericeus* and *coccygis*. The lengths of the crowns (in the toothrow) of i^2 and i^3 are, respectively, 3.5 and 1.3 mm. The crown dimensions of the two erupted molars, m^1 and m^2 are, respectively, 5.7 by 3.8 and 5.2 by 4.2.

Phalanger vestitus differs from both

sericeus of the Central Range of Papua and *coccygis* of the Saruwaged Mountains chiefly on account of the small size of its molar teeth.

The types of *P. carmelitae, sericeus,* and *coccygis* seen by me include the type and four paratypes of *carmelitae,* all collected by Loria in 1894 on the upper Vanapa River, which rises on the slopes of Mounts Scratchley and Victoria, and numbered as follows: the type, Genoa C.E. No. 10455; the paratypes, Genoa C.E. No. 10456–10457 and B.M. No. 97.8.7.87. Detailed measurements were taken of the skulls and teeth of the type and one of the paratypes in Genoa and of the London paratype. The holotypes of *sericeus* and *coccygis* were also examined. A series of measurements is shown in tables 4 and 5.

The animals of the Central Range, from Weyland Mountains to Mount Albert Edward, now appear not to differ from each other even to the extent of forming eastern and western geographical races. I am persuaded that the seeming differences between *carmelitae* and *sericeus,* whose type localities are only a few miles apart and on the same southern face of a winding though uninterrupted mountain range, are fictitious, being founded upon differences of age and molt. The presence or absence of p^3 likewise is not significant; this tooth is present in 7 out of 13 in the eastern members of the *P. vestitus* group but is lost on both sides in 6 out of 20 specimens from near Mount Wilhelmina. The tooth is present in one of the specimens from Weyland Mountains; an appropriate alveolus appears in the type of *vestitus;* and the tooth is present in the type of *coccygis* from the mountains of the Huon Peninsula.

After personal inspection of the type of *P. coccygis* and in view of the fluctuating status of p^3, retention of this form as a separate race, even though geographically isolated, seems inadvisable.

The relationship of *vestitus* of the mountains of northern Vogelkop to the silky phalangers of the Central Range and Saruwaged Mountains is obscured by the extreme youth of the single known specimen. The narrowness of the first molar may be significant, and this with the apparently extensive geographical gap in distribution (fig. 9) may perhaps warrant retention of the subspecific rank. The silky phalangers, then, may be arranged

P. vestitus, with races	
P. vestitus vestitus	Northern Vogelkop
P. vestitus carmelitae (= *sericeus* = ? *coccygis*)	Central and Saruwaged ranges

Phalanger celebensis

The view suggested earlier (Tate and Archbold, 1937, p. 315, diagram) that *celebensis* might be treated as a group coequal with the *orientalis, ursinus,* and *maculatus* groups of *Phalanger,* is now modified. *Phalanger celebensis* (fig. 8) is now regarded as one of the four full species comprising the *orientalis* group: *orientalis, gymnotis, vestitus,* and *celebensis.* This relationship is emphasized by study of a good series of a new race from Peleng Island. In these, as in the race *rothschildi,* the form of the mastoid area is somewhat more in agreement with that of *orientalis* than with true *celebensis.* In other respects they agree closely with *celebensis.*

Phalanger celebensis with its races is to be distinguished from *P. orientalis* and races by its skull size and by the distance of i^3 from c. In *P. orientalis* (except *ornatus*) the alveoli of the two teeth are separated by an appreciable gap. In that respect *ornatus* connects *orientalis* and *celebensis.*

The races of *P. celebensis* are four:

P. c. celebensis	Of the mainland of Celebes, both north and south
P. c. pelengensis	Peleng Island
P. c. rothschildi	Obi Island
P. c. sangirensis	Sanghir Island

The representative of *celebensis* found on Taliaboe of the Sula group of islands, east of Celebes, appears to be intermediate; it matches true *celebensis* in general color, though its hands are tan instead of gray; on the other hand its skull has the mastoid processes downwardly pointed as in the other island races of that species.

Phalanger celebensis celebensis (Gray)

Cuscus celebensis Gray, 1858, Proc. Zool. Soc. London, p. 105.

Phalanger celebensis Thomas, 1888, Catalogue of the Marsupialia . . . in the British Museum, p. 207.

Material Examined: The type specimen as well as photographs of the skull; our original series from south Celebes (Tate and Archbold, 1937, p. 379); also eight specimens from near Roeroekan, northeastern Celebes.

The type, B.M. No. 57.8.6.3, is a young adult male (m^4_4 not yet quite in place). The upper pelage is gray, the underparts white; no dorsal stripe. The usual coarse granulations beneath the base of the bare part of the tail also indicate its sex.

The back of the skull behind the palate is wholly sheared off. Upper m^4 of the right side is missing; that of the left side has been glued in at right angles to its proper position, its anterior face outward, thus shortening the total length measurement of the toothrow. True length of toothrow, p^4–m^4 = 18.5; p^4 with slightly developed cuspules as in *gymnotis* but the tooth very much smaller (3.9 by 3.2).

Juvenals, according to Weber, are rufescent.

No differences between southern and northern animals appear.

Phalanger celebensis sangirensis Meyer

Phalanger sangirensis Meyer, 1896, Abhandl. Mus. Dresden, vol. 6, art. 6, p. 34.

"They differ slightly from the Celebes specimens *celebensis* in their golden tint; they are warmer and brighter generally, and the face is more or less paler. . . In the five specimens which lie before me there is a slight trace of the dorsal stripe. . . " (Meyer).

This is the only race of *celebensis* of which I have not seen the type specimen. No measurements of the animals were given by Meyer. The color, as described, well matches that of *pelengensis*, but the presence of the weak dorsal stripe in *sangirensis* separates the two. It may be identical to *rothschildi* of Obi, which also possesses a dorsal stripe, but I hesitate at this stage to synonymize the two. It must always be borne in mind that these easily domesticated phalangers may have been carried about in canoes.

Phalanger celebensis pelengensis Tate

(See description, p. 3.)

Phalanger celebensis rothschildi Thomas

Phalanger rothschildi Thomas, 1898, Novitates Zool., vol. 5, p. 433.

The type of *rothschildi*, B.M. No. 98.3.-27.1, is a young male, with the back of the skull cut off. Thus, the form of the mastoids cannot be seen. The widths of the upper incisors measure: i^1, 2.5 mm.; i^2, 3.1; i^3, 1.7.

The skin (in the Tring Museum) is colored light brown, much as that of the new race *pelengensis*, but differs by possessing a distinct dorsal line on the crown of the head and from shoulders to rump. Under parts creamy white instead of the clear yellow of *pelengensis*.

A second specimen, an adult female, also from Great Obi, Genoa C.E. No. 10306, is reddish gray, with creamy white underparts and the chin and anterior part of the throat brownish. The frontal trough deep. Widths of upper incisor crowns: i^1, 2.4 mm; i^2, 2.9; i^3, 1.7.

PHALANGER MACULATUS GROUP

The phalangers of the *maculatus* group are distinguished from those of the *orientalis* and *ursinus* groups by pronounced inflation of the frontal region of the skull. Another character distinguishes the males only of the *maculatus* group from all except *P. orientalis ornatus* and *P. o. lullulae;* this is the strongly spotted pattern. A third character relates to the quite involved changes in the color and pattern of the pelage undergone during growth.

Two species of spotted phalangers are recognized in this paper, *P. maculatus* with its five geographical races, and *P. atrimaculatus*, newly described (p. 4).

A. *P. maculatus*	
1. *P. m. maculatus*	Tan and white, with white aberrations in both sexes. North New Guinea.
2. *P. m. krameri = rufoniger*	Male with dark head, most spots dark, on white ground, female dark throughout, with reddish tail, hands, and feet. A white aberration occurs. Admiralty and Ninigo Islands. Also Huon Peninsula.
3. *P. m. chrysorrhos*	Male with tan-spotted shoulders, chocolate-spotted hind-back; female with dark gray to blackish rear-back, with or without weak lateral line. South New Guinea and southern Moluccas.
4. *P. m. goldiei*	Male much whiter than *chrysorrhos*, tan coloring much reduced and chocolate spots few only and on rump. Female almost indistinguishable from that of *chrysorrhos*. Southeast New Guinea.
5. *P. m. nudicaudatus*	Tan coloring, if present, restricted to hands, feet, and tail. Spotting in male gray on white base. Female unspotted, gray above, white beneath. North Queensland.
B. *P. atrimaculatus*	Male with rear back spotted with jet black. Possibly equals the form on Waigeu in which female is also spotted. Range: ? Waigeu, ? Batante, ? Misol, and sparsely through north New Guinea as far as the Sepik River.

The interrelationship of these races is still doubtful. The two forms *chrysorrhos* and *goldiei* from south of the main divide appear very closely related, partly because of geographical considerations and partly because their females are nearly indistinguishable. The gray Australian race has not only a sharply different color tone; it is much smaller. It appears more closely related to *chrysorrhos*, its nearest neighbor, than to other races. Of the spotted phalangers north of the mountains, the status of *P. atrimaculatus* is obscure. The frequent presence of p^3, coupled with the form of the ectopterygoids, indicated that it is sharply different from all other spotted phalangers. True *maculatus*, with its white variety, is again a perfectly distinct geographical entity. The Admiralty Islands race, *krämeri*, strongly saturate in color and much reduced in size, may be derived directly from *rufoniger* of the Huon Peninsula. It lacks p^3. Its possible phylogenetic history appears in figure 6; its pattern of geographical distribution, in figure 7.

Treatment of *atrimaculatus* as a full species has seemed desirable because its range and that of *P. m. maculatus* overlap extensively. The indications of geographical overlap between *maculatus* and *chrysorrhos* that appear in the Vogelkop are not well substantiated. *Chrysorrhos* and *goldiei* may be found to intergrade in the Papuan Gulf area.

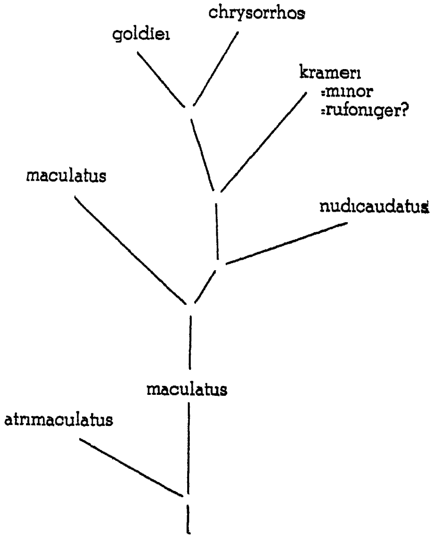

Fig. 6. Phylogenetic tree of the *Phalanger maculatus* group.

Large gaps in our knowledge of the distribution of *P. maculatus* need yet to be filled. We know that representatives of the *maculatus* group occur in the Bismarck Islands, but, although some of that material is undoubtedly contained in collections, it is not at present available, and accurate descriptions of it are wanting. So also with the spotted phalangers of the north side of eastern New Guinea from northeast of the Huon Peninsula area to Milne Bay. The eastward range of the race *goldiei* remains unascertained. Lydekker, in Allen's "Naturalist's library" (1894), states of the spotted phalangers, "unknown in the Halmahera group." Mertens (1929, p. 29) records them from eastern Flores, but Sody (1933, p. 61) questions this record.

Peters and Doria (1881) and Jentink (1885), four years later, provided short descriptions of many individual specimens of spotted phalangers from the Moluccas and western New Guinea. In some instances, naturally, unimportant characters were mentioned, while diagnostic characters were omitted. An attempt to evaluate these descriptions and allocate the individuals to races is made in table 6. Races apparently involved are (1) true *maculatus* with its white form; (2) "sooty"-spotted animals from Waigeu, males and spotted females; and (3) *chrysorrhos* of Ceram, females only (males not positively associated).

It appears that the males of topotypical *chrysorrhos* females must be chocolate spotted like our south New Guinea males, also that the lateral line in dark-backed females is not a highly significant character, since, though it is stated positively to be present in typical *chrysorrhos* of Amboina and by inference in the females from Padjang, Andai, Salayer, and Aru (two), it is particularly stated to be absent, "no black line separates the red-brown flanks from the white abdomen," in one specimen (No. 27) from Aru, and in a young female from Numfor (= Mafoor), in the Geelvink Bay. That the lateral line in these females is really a fluctuating and uncertain character is substantiated by study of two borrowed females, one adult and one half-grown, from Ceram. In the younger one no trace of lateral line appears; in the adult a very slight irregular deepening of the dark gray is the only indication of it. So also with most of our south New Guinea material. In a few cases the sides, adjoining the white of the belly, are slightly darker. Thus the south New Guinea race, which must also be referred to *chrysorrhos*, is seen ranging

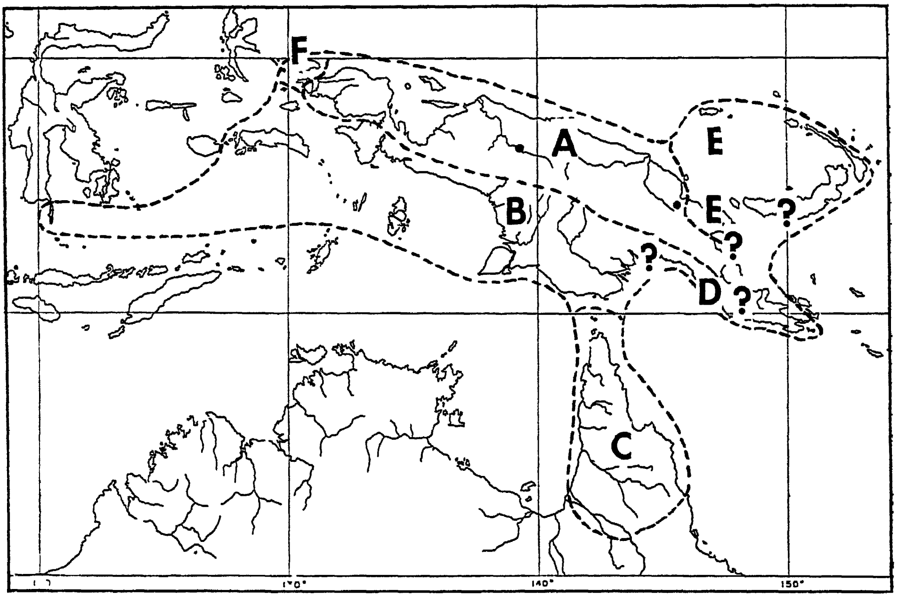

Fig. 7. Pattern of apparent distribution of the *P. maculatus* group: (A) *P. m. maculatus;* (B) *P. m. chrysorrhos;* (C) *P. m. brevicaudatus;* (D) *P. m. goldiei;* (E) *P. m. krameri;* (F) *P. m.* race with spotted females. The interrogation marks show lack of knowledge of the race on New Britain and of the eastward extent of the ranges of *P. m. maculatus* and *P. m. goldiei.* The two dots mark *P. atrimaculatus.*

west and northwest to Aru, Kei, Ceram, and adjoining islands, even to Salayer, and on the mainland thrusting northwest along the south side of the mountains into the southern part of Vogelkop (Triton Bay). A single specimen from Andai indicates extension northward along the east side of Vogelkop.

According to Jentink the phalangers with "sooty black" spots occur on Misol Island, animals with "glistening black" spots on Waigeu, with "black" spots on Ceram, and "sooty black—same as no. 28" on "New Guinea."

It is unfortunate that females of *atrimaculatus* were not secured by the Archbold collectors. That part of the problem relating to spotted females seems to be insoluble for the time, as two types of females apparently occurred: on Misol "back and flanks sooty," on Waigeu "colored and spotted like the males. . .underparts pure white;" on New Guinea (Andai) "midmost part of back sooty black. . .underparts pure white." On Ceram no females were recorded.

The term "sooty black" in the case of females is less distinctive and, therefore, less convincing than in the case of males. That is because females of all the races except *P. m. maculatus* have blackish or very dark brown backs.

Spotting in females in *Phalanger*, although known to be frequent on the island of Waigeu, is by no means restricted thereto. Occasional spotted females are known from Aru and Kei, and an aberrant one, A.M.N.H. No. 108102, with small dark gray spots on a light gray ground, comes from Penzara, Wassi Kussa (River), south coast of south New Guinea. A second but juvenal individual, U.S.N.M. No. 267395, with apparently similar type of pelage, is from western Ceram. Spotted females, except those from Misol and Waigeu, appear to be referable to the race *chrysorrhos* and to occur only as occasional aberrations. It is suggested—without expression of definite opinion—that the black-spotted males and females of Misol and Waigeu may represent an extension of the species *atrimaculatus* to those islands. Whether the black-spotted females are truly the females of *atrimaculatus* or are the product of a localized genetic change must be decided when more evidence has been procured.

Phalanger maculatus maculatus (Geoffroy)

Phalangista maculatus Geoffroy, 1803, Catalogue des mammifères du Musée National d'Histoire Naturelle, Paris, p. 149.

Phalangista papuensis Desmarest, 1822, Mammalogie, p. 541.

Etienne Geoffroy St. Hilaire in 1803 published the first description of a spotted phalanger under the name *maculatus*. ". . .Characters. Fur white, spotted with brown; two lateral incisors in the lower jaw. Description. Fur of the upper parts of the body yellowish white, spotted with brown; the two lateral teeth very large and triangular, in height almost filling the interval between the incisors and the molars; ears hairy inside as well as outside; claws very small. Country. The Moluccas."

The name *maculatus* Geoffroy must be fixed upon one of the recognizable geographical races, and its type locality must be restricted, preferably fixed. Buffon had earlier described and figured a male "Phalanger tacheté" without binomial name. It is well spotted, neither densely nor thinly. There is no visible suggestion that the spots of the rear back are at all darker than those of head and shoulders, as is the case in males from south New Guinea. This fact coupled with Geoffroy's simple, "white, spotted with brown," may be taken to indicate the race (males only) now known to be most abundant in north New Guinea. This race has large brown spots and blotches unmixed with chocolate or black, upon a white ground, and is distributed in north New Guinea from the Vogelkop at least as far east as the lower Sepik River. The Archbold Collection contains a large series from the Cyclops Mountains area and from the upper Idenburg River, 150 feet.

There remains the problem of restriction of type locality, given by Geoffroy as "Moluccas." No evidence exists that this particular race, the pale brown spotted phalanger, occurs at all on the Moluccas as delineated today, or indeed on any of the islands west of the New Guinea mainland.

It is present, however, on the islands in the Geelvink Bay.

For a long time before Geoffroy wrote (1803), the Dutch had been administering the Moluccas from a center located at Amboina. Subadministrative centers, coöperating with the local sultans of Ternate and Tidore, functioned at Ternate, Waigeu, Kei, and Dorei (= Manokwari) on New Guinea. The history of voyages of discovery leading to present-day development of the Moluccas and New Guinea has been ably traced by Wichman (1909). Recently Vlekke (1943) has illustrated the political and trading picture and the domination by the two sultanates Ternate and Tidore of the Moluccas and western New Guinea (see his maps, facing pp. 136, 304).

In view of the fact that western New Guinea was in 1800 considered a part of the Moluccas, and that typical *maculatus*, though plentiful on the mainland, is apparently absent from the islands west of New Guinea, I now restrict the type locality of *maculatus* Geoffroy, 1803, to the Vogelkop, and specifically to Dorei (now Manokwari), which was then the most important port of call in the region. This restriction has been fortified by my examination of a Chicago Museum specimen from Manokwari, F.M.N.H. No. 31754, female, which represents in my opinion true *maculatus*. A pair, male and female A.M.N.H. Nos. 100881, 100882, from Momi (virtually equal to Wariap), on the west coast of the Geelvink Bay and only 50 miles south of Manokwari, further substantiate the identity of true *maculatus*. Concerning a male from Dorei (No. 42), Jentink (1885) wrote, "spots are of a very light tinge, giving the impression as if the animal is entirely white colored. Perhaps an albino." The male from Dorei (= Manokwari) described by Peters and Doria (1881) was colored "head, neck and inner part of limbs ferruginous; back yellowish, spotted with brown, underparts and tail reddish yellow." There can, therefore, be no possible doubt of the presence of this race of spotted phalangers in the restricted type area.

Phalanger papuensis Desmarest can be synonymized almost exactly with my young female *P. m. maculatus* in stage 2: "body gray; top of head brown; underparts yellowish white; extremities of fingers and feet brown. . .a little smaller than the white phalanger."

Phalanger quoy Gaimard and *P. macrourus* Lesson and Garnot, included by Cabrera (1919) in the synonymy of *P. maculatus*, are now placed in the *orientalis* group for reasons given thereunder.

Phalanger variegatus Schinz, 1821, due to the present inaccessibility of the work in which it was described, has not been identified. It may be either one of the *maculatus* group or *ornatus*, judging from its name.

GROWTH STAGES

The Archbold series representing this race is much larger than in the case of *P. m. goldiei* but is still inadequate to show all the growth stages. Collections from two main localities are before me: from Hollandia and the region about the Cyclops Mountains, and from the upper Idenburg River. A tendency toward dilution of the pigmentation possibly results in completely white specimens of both sexes. But a complete series from brown to white is wanting. Brown and pale brown individuals are separated by a wide color gap from white or yellowish white ones.

The growth stages (table 7) of *P. m. maculatus* from two areas in north New Guinea, when compared with the more complete series (table 8) for *P. m. chrysorrhos* of south New Guinea beyond, show that females of the northern race become actually larger than males, as stated by Jentink, but that in the southern race this does not hold.

Comparison of *P. m. maculatus* from the north coast with the strain found inland on Idenburg River reveals further small differences, which must be viewed with reserve on account of the small number of samples. The inland race appears to reach greater over-all size than the coastal race; this is expressed chiefly through greater tail length and foot length.

Color Pattern

Because of the woolly character of the pelage, none of the three specimens in stage 1 is to be regarded as pouch young. Known pouch young (i.e., *chrysorrhos*) have without exception extremely short fur. Although the dentition has developed only to stage $m\frac{1}{1}$, the pelage is very different from that of our specimens of the race *chrysorrhos* actually found in the pouches, being longer, slightly crimped and glossy, with an indication of the adult pattern. In the very young male from the Idenburg River, faint dark gray spots show on a ground of lighter gray. In the younger female from the Cyclops area, the color is gray, but the dark lateral line is already well defined, and the face, hands, feet, and tail show traces of rufescent coloring. The gray dorsal color of the older stage-1 female, slightly further advanced, has already become considerably paler.

Stage-2 animals already show a marked change in the direction of adult pattern. In the several males the brown spotting on a white ground is clearly established; the light brown spots are still mixed with darker, not clear brown as in adults. Females are in various states of transition from gray to brown, their lateral lines strongly defined.

Stage 3 in every case already shows adult color pattern.

Phalanger maculatus chrysorrhos (Temminck)

Phalangista chrysorrhos Temminck, 1827, Monographies de mammalogie, vol. 1, p. 12.

When we worked upon the relationship of the spotted phalangers earlier (Tate and Archbold, 1937), our material from south New Guinea was assumed to be identical with the race *goldiei* Ramsay from Port Moresby, which was based upon a single female. Recent collection of several topotypical males of *goldiei* indicates that the south New Guinea spotted phalanger belongs not to *goldiei* but to a distinct race, and that it appears referable to *chrysorrhos* Temminck.

The following is a detailed description of an adult male of this race: A.M.N.H. No. 108083, adult male from Lake Daviumbu, middle Fly River. Basal coloring white; head, limbs, and tail light brown near Ochraceous Tawny, becoming rufescent on feet and hands; ear tufts white; back, from shoulder to rump, spotted with dark chocolate brown often nearing Mummy Brown, the density of the spotting such that there are about as many white spots as chocolate spots. This dark brown spotting extended onto the hind limbs. Underparts white.

Description of skull of same: a characteristically *maculatus*-like skull of moderate size, in growth stage 4 ($m\frac{4}{4}$ developed but unworn). No characters to distinguish skull from other races.

Measurements: Skin (taken in field), total length, 1030 mm.; tail, 510; hind foot (s.u.), 82. Skull, condylobasal length, 95; zygomatic width, 62; palatal length, 54; mastoid width, 48.5; outer width across p^{4-4}, 32; toothrow, length, c–m^4, 47.5; p^4–m^4, 31.2; p^4, 6.3 by 5.9; m^4, 6 by 5; mandible, front of incisive alveolus to articular process, 72.

A very large series of specimens of all ages and both sexes is available from various parts of the Fly River basin and the Oriomo Ridge (south of the Fly River). A study has been made beyond of the growth stages of this race.

A few examples showing reduction of the quantity of spots in males appear to be annectant with *goldiei*. The contact area of the two races is presumed to be in the Gulf Division (Kikori area), from which region no material is available.

Phalanger chrysorrhos Temminck was founded upon dark-backed females marked with a character otherwise peculiar to true *maculatus*, namely, the dark lateral line which separates the dark dorsal coloration from the whitish ventral. When I examined the two female cotypes at Leiden I was unaware of the significance of the lateral line and so failed to remark its presence or absence. In females of *chrysorrhos* from south New Guinea, although the dark along the sides is intensified—chiefly by reduction of the dorsal covering of whitish guard hairs—there is no narrow contrasting line such as is seen in females of *P. m. maculatus*. Yet Temminck wrote "the white of the underparts is separated from the ashy which covers the sides by a black band in adults, only blackish in young individuals." He also alluded to males, but there is acually no description in his work of animals which are unquestionably topotypical males of *chrysorrhos*.

GROWTH STAGES

The Archbold Collection contains more than 50 specimens of the race *P. m. chrysorrhos*. The salient growth characters correlating dental development with progressive changes of pelage and skull development are set forth in table 8. Five stages in dental development are recognized. No evidence can be drawn from the dates of capture tending to show seasonal breeding rhythm; reproduction seems to take place at any time through the year.

The two males and the female appearing in stage 1 were actually collected from the pouches of females. Increase in length of the tail seems to cease at stage 4 in females, as does also increase in zygomatic width.

COLOR PATTERN

The development of the pelage can be readily traced in the two sexes. In the pouch young the fur is short and close, slaty gray dorsally and dull white ventrally. An indication of developing pattern shows in one of the males (A.M.N.H. No. 108-099), in the buffy white ears and some irregular buffy patches on the hind limbs and at the base of the tail.

Pelage in both sexes develops rapidly after the pouch has been vacated. Males in stage 2 already show weak grayish brown dorsal spotting on a ground color pale silvery gray, with ears buffy white. Females of corresponding age have the dorsal color brownish gray, sometimes more reddish, with sharply contrasting buffy white ear patches, and the ventral color and inner sides of limbs white. No trace can yet be observed of the blackish color of the posterior half of the back, present in adult females. This stage corresponds to the "nebulous" phase of Jentink.

In stage 3, most males have already assumed the bright adult coloration. Females yet retain to some extent the silvery hair tips and indefinite pattern of stage 2, but the lower dorsal area is definitely becoming darker brown.

In stage 4, fully adult coloration has been reached by females as well as by males. The coloring of males is shown in the detailed description given earlier. That of characteristic females is as follows: Normally no spots developed. Posterior half of back uniform deep blackish brown, the tips of hairs shining buffy—rarely silvery; face, hands, and feet light chestnut, foreback, neck, shoulders light brown, tail light brown. In both sexes the rump adjoining the base of the tail is light yellow-brown. No sharp lateral line such as shows in *P. m. maculatus*, but the sides appearing blacker due to absence of pale guard hairs. Hence, probably, Temminck's description of *chrysorrhos*.

ERUPTION OF TEETH

Functional teeth are limited in stage 1 (pouch young) in the upper jaw to the large, flat-crowned, permanent second incisor, i^2 in adult dentition, the milk fourth premolar, and the first molar (which is not quite in position); and in the lower jaw to the projecting tips of the large procumbent incisor, the lower milk fourth premolar and the lower first molar. In the upper series the tips of the permanent i^1, the flat-crowned i^3 and p^2 are just visible. The canines are only partly erupted. On the other hand the very small tubercle-like, lateral lower incisors (or premolars?) are already rounded and worn. They were perhaps used in the pouch before the eruption of the procumbent incisors for holding the mamma, and opposed the flat-crowned i^2. At stage 1 they are close together, almost contiguous, though destined before adulthood to move a full crown-length apart.

In stage 2, which by definition has $m\frac{2}{2}$ in place, the principal additional change in the teeth appears in the incisors, canines, and premolars. The pointed i^1 and the flat-crowned i^3 are both in place, the latter already exhibiting slight wear. The canine, though functional, is still only partly extruded. The second premolar is fully erupted. The procumbent lower incisor is fully functional, though still only partly erupted. The frontal swelling, characteristic of all *maculatus*, unrecognizable in stage 1, is quite well developed in stage 2.

In stage 3, with $\mathrm{m}\frac{3}{3}$ in place, the earliest developed incisor, i^2, is in an advanced state of wear, and both i^1 and i^3 show moderate wear of the crown surfaces. The canine and p^2 are farther protruded. The most significant feature of this growth stage, however, is the replacement of the milk fourth premolar by the permanent premolar. In three of our stage-3 males the milk tooth is still functional, in two others it has been thrust aside by the erupting permanent tooth, and in the female, which is a larger, more advanced animal, the milk tooth has been displaced and the permanent tooth is fully in position. The lower incisors are now thrust forward so far that the whole of the flattened, chisel-shaped crown is about 2 mm. beyond the alveolus.

Stages 4 and 5, respectively, with $\mathrm{m}\frac{4}{4}$ in place, unworn, and $\mathrm{m}\frac{4}{4}$ much worn, offer only progressive additional phases of wear in the earlier developed teeth. The first incisors have continued lengthening and thickening from their persistent pulps and because of attrition of their posterior faces by the lower incisors have assumed a somewhat chisel-like form. The crown of i^2 is much eroded; in stage 5 it may be completely worn down to the stump-like root. The crown of i^3, a non-persistent tooth, often shows oblique wear from rubbing against the lower canine.

In stage 5 the canine, second premolar, and the first incisor may show extreme wear, being either broken or reduced in some cases to rounded stumps.

Males in stage 5 show the anterior part of the zygoma with greater flare, which causes the point of maximum zygomatic width to lie farther forward than it does in most stage-4 skulls.

Phalanger maculatus goldiei (Ramsay)

Cuscus chrysorrhos var. *goldiei* RAMSAY, 1876, Proc. Linnaean Soc. New South Wales, vol. 1, p. 395; 1879, *ibid.*, vol. 3, p. 243.

MATERIAL EXAMINED: Our original female (below), and a series of five males and three females, all from near the type locality.

The type has not been studied. Ramsay's description was based upon a female. As stated earlier, the females of *goldiei* are nearly indistinguishable from females of *chrysorrhos* in our collection from south New Guinea.

When we wrote before (Tate and Archbold, 1937), a single female of *goldiei* and a short series of *chrysorrhos* from south New Guinea only were available, and the differences provided by the males could not be noted.

Description of adult male: A.M.N.H. No. 108121. General color white above and below, becoming very slightly yellowish on top of neck and shoulders. A few large brownish or blackish spots on mid-back, either scattered or partly confluent, never anastomosing to form large brown areas as in males of *chrysorrhos*. Top of face anterior to ears, hands, and feet dark tan. A few gray marks on outer sides of hind legs.

The skull differs from that of south New Guinea *chrysorrhos* by its rather more tapered outline and especially by the great size of the molar tooth series; m^4 in particular is large (7 by 5.8 mm., compared to 5.5 by 4.8 in A.M.N.H. No. 104404 from south New Guinea). Corresponding differences show in the lower molars.

Juvenal specimens are also very pale. Spotting in them originates as a few silvery gray and light brown marks on the back.

Limits of range in the case of this race are not known. Our specimens come from behind Port Moresby and from the Kemp Welch River, a few miles to the southeast.

GROWTH STAGES

A poor representation of the growth stages is available:

Stage 2, one male
State 4, four males, two females
Stage 5, one male, one female

The stage-2 male shows no significant differences in the manner or order of development. It is distinctly older within its group, $\mathrm{m}\frac{2}{2}$ being fully, instead of nearly, in place. The pelage pattern is rather more mature.

No significant differences in the growth pattern, as outlined under *P. m. chrysorrhos*, are observable in the adults and old adults.

Phalanger maculatus nudicaudatus (Gould)

Phalangista nudicaudatus Gould, 1849, Proc. Zool. Soc. London, p. 110.

Cuscus brevicaudata Gray, 1858, *ibid.*, p. 102.

Cuscus brevicaudata Gould, 1860, Mammals of Australia, vol. 1, pl. 21.

Cuscus maculatus var. *ochropus* Gray, 1866, Proc. Zool. Soc. London, p. 220.

Gray renamed this animal *brevicaudatus* and described *ochropus* on the basis of its tan-colored feet. Agreeing with Iredale and Troughton (1934), I regard the two as subspecifically identical.[1]

The Australian phalanger is, however, markedly different from its allies in New Guinea. The color is gray on white, rather than tan or brown and chocolate on white. When brown is developed it seems to be restricted to the feet. Furthermore, the size of the animal, together with its skull and teeth, is decidedly smaller than that of adjoining New Guinea.

The type of *nudicaudatus* from "Cape York" is a juvenal female (stage 1), B.M. No. 51.1.11.17. The skin is colored gray with buffy white underparts and carries no distinctive marks. A second specimen, B.M. No. 23.12.16.33, adult female from Lloyd's Bay, is also gray and white. An adult male, stage 4, M.C.Z. No. 29271, from the McIlwraith Range, is white, with the back heavily spotted and marbled with gray, becoming continuously gray on head, neck, and shoulders. Tail white, no brown on hands and feet.

The type of *ochropus*, B.M. No. 66.4.23.4, from Port Albany, is an old female. It is also gray, but the feet are colored light tan.

Some dimensions of the skulls of the foregoing types are submitted for comparison (table 9) with those of *chrysorrhos*, *goldiei*, and *maculatus*.

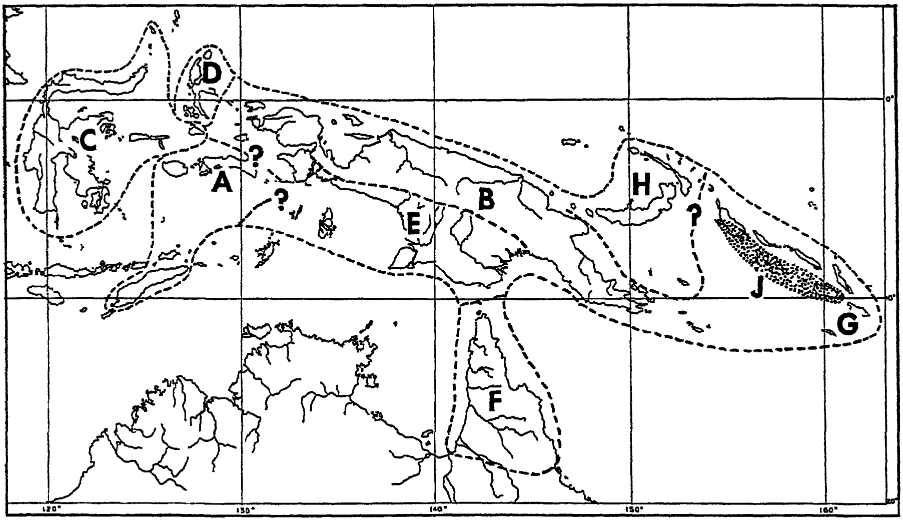

Fig. 8. Apparent pattern of distribution of the *P. orientalis* group (part): (A) *P. o. orientalis;* (B) *P. o. vulpecula;* (C) *P. celebensis*, full species; (D) *P. o. ornatus;* (E) *P. o. mimicus;* (F) *P. o. peninsulae;* (G) *P. o. breviceps;* (H) *P. o. ducatoris;* (J) *P. o.* race, the chocolate-colored, *vestitus*-like form of the southern arc of the Solomons. Interrogation marks indicate uncertainty in regard to boundaries.

Phalanger maculatus krämeri Schwarz

Phalanger maculatus krämeri Schwarz, 1910, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 406.

Phalanger maculatus minor Cohn, 1913, Zool. Anz., pp. 507–516.

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[1] Although the type specimen of *brevicaudatus* Gray is a member of the *maculatus* group, Gould's plate, labeled "*brevicaudatus*," shows a gray cuscus essentially similar to the new *P. o. peninsulae.*

Phalanger maculatus rufoniger ZIMARA, 1937, Anz. Akad. Wiss. Wien, p. 35.

MATERIAL EXAMINED: Our original small series of skins and skulls from Manus Island, Admiralty Group, including one white female.

The adult female *rufoniger* from the Sattelberg, Huon Peninsula, New Guinea, described by Zimara, may either be identical to *krameri* or may represent the mainland parent form from which *krämeri* of the Admiralty and Echiquier Islands has been derived. The description of its coloring agrees reasonably well with Admiralty females. No dimensions were given, nor were any particulars of the skull offered.

Phalanger atrimaculatus Tate

(For description of this second full species of the *P. maculatus* group, see p. 4).

PHALANGER URSINUS GROUP

These large phalangers of Celebes and the Talaut Islands are still thought to form a distinct offshoot of the genus; group characters were given earlier (Tate and Archbold, 1937). The unusually short, broad rostrum, the short canine, and the enlargement of i^3 require greater emphasis. Geographical distribution of this group appears in figure 9.

Examinations of the type specimens of *ursinus* and *melanotis* recently have provided a slightly different orientation of the systematic problem posed by this group. *P. melanotis* in particular is without doubt a sharply distinct race, only distantly related to *P. maculatus*. Although the superficial resemblance of its pelage to that of females of *P. maculatus chrysorrhos* lends some support to Schwarz's view (1934), the skull of *melanotis* reveals its unmistakable relationship to *ursinus*, especially in the broadening of the anterior nares, the enlargement of i^3, and the reduction of the canine.

Phalanger ursinus

The group is limited to a single species composed of several races.

Phalanger ursinus ursinus (Temminck)

Phalangista ursinus Temminck, 1827, Monographies de mammalogie, vol. 1, p. 10.

MATERIAL EXAMINED: Four of the cotypes collected by Müller and Macklot in north Celebes (three now at Leiden, one at London); our original small series; and two new collections; 24 specimens from the Peleng Islands.

The very black mountain race *furvus* from central Celebes, represented by three specimens, is retained, though, as shown in table 10, some of the size differences attributed to it are no longer valid.

The normally grizzled northern *ursinus* display few color variations of importance. But study of the teeth reveals a probably significant race character in the shape and size of the outer upper incisor. It has already been pointed out that in *ursinus* this is a well-developed tooth, thus differing from all other known species of *Phalanger*. The tooth assumes two forms, with occasional intermediates, and rarely a different shape on either side of the head. In the case of the Celebes specimens and those from Peleng Islands the crown of the tooth is relatively straight and its cutting edge blade-like, with sometimes slight indentations or flutings on the inner or outer faces of the tooth. In animals from the Togian Islands the crown is not only considerably elongated but is divided into a larger anterior cusp and a smaller posterior one, while a pronounced groove confluent with the depression between the two cusps appears on the outer face of the tooth. These differences show up partly in actual measurements (see p. 28).

It is to be noted that though *furvus* falls in with the second group as regards crown length, the crown in this race is not divided. This special development of i^3 is somewhat analogous to the folding of the enamel in i^3 of some Macropodidae.

Study of this long series of specimens has emphasized the rarity of really large, old

LOCALITY	NO. OF SPECIMENS	CROWN LENGTH OF i^3	REMARKS
North Celebes	6	2.7–3.1 mm.	i^3 unicuspid; crown short
Peleng Islands	7	2.7–3.2	
Togian Islands	9	3.4–4.1	i^3 bicuspid; crown long
Middle Celebes	1	3.9	i^3 unicuspid; crown long
South Celebes	2	3.6–4.0	

animals in the *ursinus* population. Of all those examined, only four have skulls exceeding 100 mm. in length; these include a male cotype of *ursinus*, the type (male) of *furvus* (which was described as larger than *ursinus*), and two females from south Celebes. Extreme broadening of the frontal area and marked development of the sagittal crest are not attained until animals reach this size, though the dental series is completed and sexual maturity is reached at a considerably lower size level. Thus, all teeth are in place in animals whose skulls exceed 87 mm. in length. Most adults in the collections have the skull between 90 and 98 mm. in length.

In the grizzled race no color difference is apparent between males and females or between adults and young. No pouch young have been seen.

In general the animals from the north of the island have brown ears and brownish faces, while those from the center and south of the island have black ears and little or no brown on the face. This distinction is not strictly in accordance with the division according to the third upper incisor, as Togian Island specimens have the brown ears of northern animals combined with the grooved third incisors, while Peleng Island specimens, also with brown ears, have small, simple upper third incisors.

Phalanger ursinus melanotis Thomas

Phalanger melanotis THOMAS, 1898, Novitates Zool., vol. 5, pp. 2–3.

The type, B.M. No. 97.12.6.8, was recently reëxamined. The general dorsal color is pale gray, the result of well-developed whitish hair tips with fuscous brown hair bases showing through slightly. The underparts buffy white, with gray bases. The skin looks slightly like that of female *P. maculatus chrysorrhos*, but shows many differences, notably the blackish ears, yellow hands, feet, and tail.

The skull is heavily built, with the nasals expanded in front and behind much as in *ursinus*. The disparity between the interorbital and intertemporal widths, so noticeable in old *ursinus* (but only in old specimens), does not show in *melanotis*. The mastoid processes are not greatly expanded; they are rounded when viewed from behind and only slightly compressed from front to back. The teeth are substantially like those of *P. ursinus*, especially in the very short canine and the large size of i^3. The last molar is unusually small. The crown length of the incisors, taken along the toothrow: i^1, 3.9 mm.; i^2, 2.7; i^3, 3.3. Supplementary measurements of the type skull are given in table 10 for comparison with those of *ursinus*.

It will be noted that the crown length in i^3 is intermediate between those of *ursinus* and *furvus*. No indication of a notched condition of the crown, such as appears in Togian Island specimens, can be seen in my photographs of the type skull. The black color of the ears agrees with the southern race *furvus*, not with *ursinus*.

Phalanger ursinus togianus Tate

(See description, p. 4.)

Phalanger ursinus furvus Miller and Hollister

Phalanger furvus MILLER AND HOLLISTER, 1922, Proc. Biol. Soc. Washington, vol. 35, p. 115.

MATERIAL EXAMINED: One young adult male from the Latimodjong Mountains, 800 meters, near the type locality; two females from Mount Lampobatang, 2000 meters.

The glossy black pelage of the young male agrees closely with Miller's description of *furvus*. On the other hand the old animals from Lampobatang, formerly referred to *ursinus*, have the tips of the hairs grizzled, though the ears are black, not brown as in true *ursinus*. But comparative study of the teeth in these animals, especially of i³, indicates similarity to each other and difference from the northern races. They differ from the Menado race, typical *ursinus*, by having the crown length of i³ much greater, and from the Togian Islands race by lack of the groove and double cusp in i³.

NOTES ON WHITE PHALANGERS

The appearance of white individuals in both *P. orientalis* and *P. maculatus* seems to be unrelated. In *P. orientalis*, white animals are invariably males. They appear in the typical race *orientalis* and again in the race *ducatoris* from the Bismarck Archipelago. In *P. maculatus*, the race *P. m. maculatus* is known to produce white individuals of either sex. Also a single white female of *P. m. krämeri* is contained in our collection. White individuals are unknown in the *ursinus* group or in *P. celebensis*.

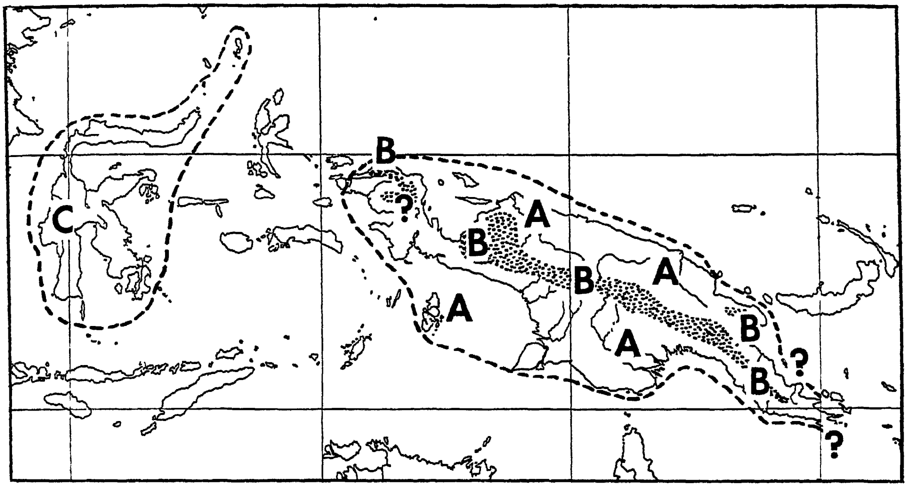

Fig. 9. Distribution pattern in the species *P. gymnotis* (A), and *P. vestitus* (B stippling) of the *P. orientalis* group, and the *P. ursinus* group (C). Due to the high altitudes preferred by *vestitus* and the low to middle altitudes at which *gymnotis* occurs, there is a minimum of overlap in these two species. The interrogation mark in Vogelkop indicates uncertainty about the presence there of *gymnotis*.

The White Phase of *P. orientalis*

Kopstein (1926), who studied phalangers during two and a half years residence in the Moluccas, found that whiteness in *P. orientalis* developed only in adult males, juvenals showing the "typical pelage of the female." Among the many pouch young brought to him, he saw but one white one. He never once observed a white male with red iris, so reached the conclusion that he was dealing not with true albinism but with "a tendency to assume a white color in age." This appeared especially characteristic for Amboina (the type locality). "Other Moluccan" islands investigated by him for white cuscuses were Saparua, Haruku, Buru, Ceram, Sula, and Banda. Jentink (1885, p. 96), however, quoted Valentijn (1724–1726) as saying "these white specimens always are adult males and have red eyes."

The White Phase of *P. m. maculatus*

White-coated animals appear in both sexes. From the appearance in stage 2 of perfectly white individuals it may be surmised either that they become white while yet in the pouch or that they develop directly from the dark gray pouch young of early stage 1. One stage-2 male, A.M.N.H. No. 151819 from Hollandia on the coast, and two stage-2 females, A.M.N.H. No. 151804 from Idenburg and A.M.N.H. No. 109454 from Hollandia, are fully developed white forms, the male with very faint yellowish tinge, the females wholly lacking the normally present lateral line. A female without skull from the Cyclops area, of stage-2 size, shows traces of yellowish on the hair tips of feet and tail. An adult male and female from Idenburg River, both in stage 4, and a stage-5 female from Cyclops complete the series of white individuals. No trace of spots appears in any male, or of lateral line in any female. In the Idenburg adult female the base of the tail is buffy on top.

Areas of pelage in normal males and females of *P. m. maculatus* which are brown in color have their hair bases white or whitish and shorter brown hair tips. It is not thought, however, that pure white specimens represent merely the last stage of a process of color dilution. The break between pale brown forms and white forms appears to be absolute. Pure white animals may be true albinos or they may be "dominant whites." They are to be compared with white *P. orientalis*, which, however, appears to be sex-linked, being found only in males.

The white female of *krämeri* from the Admiralty Islands is unique. Several normal males and females from the same locality accompany it. Whether or not it was a true albino is not known.

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TABLE 1

SIGNIFICANT MEASUREMENTS IN *Phalanger orientalis* FROM ISLANDS WEST OF NEW GUINEA

	p^4–m^4	L.[a] mp^4	W.[b] mp^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Cond.-basal Length	Zyg. Width	Mast. Width	Pal. Length
Topotype of *P. o. orientalis* B.M. 83.3.24.7 Old albinistic male	22.7	—	—	5.1	4.0	5.0	4.1	4.2	3.8	89.5	64.3	49.0	50.5
"Type" of *P. cavifrons* Leiden M-3 Juv.	—	3.9	3.2	—	—	5.1	4.0	—	—	—	—	—	—
Type of *P. ornatus* B. M. 60.1.10.18 Old adult male	21.0	—	—	5.0	4.3	5.0	3.9	3.5	3.0	77.7	49.2	41.0	43.0
Halmahera Genoa C.E. 10315 Adult female	20.7	—	—	4.4	4.2	4.8	4.2	3.5	3.4	—	43.7	—	38.4
Halmahera M.C.Z. 7000 Adult female	24.0	—	—	5.2	4.5	5.4	4.5	4.4	3.9	—	52.0	46.0	48.0
Wetar Island A.M.N.H. 809333 Adult male	26.0	—	—	5.8	4.7	5.6	4.6	5.3	4.8	92.0	62.0	47.0	49.0
A.M.N.H. 80935 Adult female	25.8	—	—	5.2	4.6	5.8	4.5	5.3	4.4	91.0	57.0	49.0	49.0
A.M.N.H. 80936 Adult female	25.8	—	—	5.3	4.4	5.4	4.3	5.4	4.7	85.5	53.0	46.5	47.0

[a] Length.
[b] Width.

TABLE 2

SIGNIFICANT MEASUREMENTS OF *Phalanger orientalis vulpecula* (= *interpositus* = *brevinasus* = *matsika* ?) FROM NEW GUINEA MAINLAND

	p^4–m^4	L. mp^4	W. mp^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Cond.-basal Length	Zyg. Width	Mast. Width	Pal. Length	Growth Stage
Topotype of *P. o. interpositus*														
A.M.N.H. 101998														
Adult female	25.5	—	—	5.2	4.5	6.0	4.5	5.0	4.5	79.0	50.0	42.5	43.0	4
Type and paratypes of *brevinasus*														
A.M.N.H. 104100														
Old male	23.9	—	—	5.0	4.0	6.0	4.5	4.4	4.0	84.0	56.0	46.0	47.0	5
A.M.N.H. 104099														
Young adult male	25.1	—	—	5.3	4.4	5.6	4.5	4.7	3.9	79.0	48.0	42.0	44.0	4
A.M.N.H. 104148														
Adult male	24.4	—	—	4.8	4.0	5.5	4.4	4.8	3.9	84.0	54.0	43.0	47.0	4
Juvenal males of *matsika*														
A.M.N.H. 104120	—	4.4	3.3	—	—	5.9	4.5	—	—	—	—	—	—	2
A.M.N.H. 104121	—	4.3	3.1	—	—	5.8	4.2	—	—	—	—	—	—	2
A.M.N.H. 108541	—	4.9	3.4	—	—	5.9	4.3	—	—	—	—	—	—	1
Cyclops Mts.														
A.M.N.H. 151818	—	4.4	2.7	—	—	5.4	3.9	—	—	—	—	—	—	2
A.M.N.H. 109653	—	4.2	3.0	—	—	5.3	4.1	—	—	—	—	—	—	2
A.M.N.H. 109432	—	4.4	2.9	—	—	5.0	3.9	—	—	—	—	—	—	2
Type and paratypes of *matsika*														
A.M.N.H. 104103														
Young adult female	24.4	—	—	4.8	4.0	5.4	4.5	4.6	3.9	77.0	45.0	39.0	42.0	4
A.M.N.H. 108569														
Adult female	24.5	—	—	5.1	4.3	5.4	4.3	4.7	4.1	84.0	55.0	46.0	48.0	4
A.M.N.H. 108570														
Adult female	23.8	—	—	4.8	4.0	5.4	4.2	4.7	4.0	81.0	47.0	46.0	45.0	4
Juvenal females														
A.M.N.H. 104127	—	4.2	3.0	—	—	5.6	4.2	—	—	—	—	—	—	2
A.M.N.H. 104115	—	4.3	3.1	—	—	5.4	4.2	—	—	—	—	—	—	2
A.M.N.H. 108542														
(Young of 108569)	—	4.6	3.3	—	—	5.5	3.9	—	—	—	—	—	—	1
Idenburg R.														
A.M.N.H. 151852														
Young adult female	—	—	—	—	—	5.1	4.2	4.7	4.2	79.0	49.0	40.0	42.0	3
Cyclops Mts.														
A.M.N.H. 109433														
Adult female	23.6	—	—	4.8	4.0	5.3	4.1	4.5	4.1	84.0	52.0	44.0	48.0	4
A.M.N.H. 109653														
Juv. female	—	4.1	3.0	—	—	5.3	4.1	—	—	—	—	—	—	2

TABLE 3

Phalanger gymnotis (with *P. leucippus*). Dental Measurements of Types and Other Material from New Guinea

	p^4–m^4	L. mp^4	W. mp^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Growth Stage
Type of *P. gymnotis*										
Genoa C.E. 1545/3966										
Adult male	25.3	—	—	—	—	6.1	4.9	4.6	3.9	4
Cotypes of *P. leucippus*										
Genoa C.E. 10454										
Adult male	23.8	—	—	—	—	5.2	4.3	4.2	3.7	4
B.M. 97.8.7.88										
Old male	24.5	—	—	5.8	5.2	5.8	4.4	4.4	3.5	5
Virtual topotypes of *leucippus*										
A.M.N.H. 104097										
Old male	25.3	—	—	6.0	5.6	5.5	4.2	4.4	3.8	5
A.M.N.H. 104147										
Adult male	24.6	—	—	5.9	5.6	5.3	4.3	4.5	3.7	4
Lower Sepik R										
F.M. 31861										
Adult male	—	—	—	6.3	5.5	5.4	4.3	—	—	4
Upper Idenburg R.										
A.M.N.H. 151846										
Old male	23.6	—	—	5.1	4.6	5.4	4.6	4.5	3.9	5
A.M.N.H. 151849										
Male	—	—	—	5.7	5.6	5.4	4.5	—	—	3
A.M.N.H. 151798										
Old male	24.7	—	—	5.6	5.2	5.5	4.6	4.5	4.0	5
Cyclops Mts.										
A.M.N.H. 109437										
Adult male	25.4	—	—	5.8	5.4	5.5	4.2	4.7	4.0	4
A.M.N.H. 151860										
Adult male	25.8	—	—	6.0	5.7	5.5	4.5	4.7	3.9	4
A.M.N.H. 109438										
Old male	25.4	—	—	6.1	5.4	5.4	4.5	4.8	4.3	5
Virtual topotypes of *leucippus*										
A.M.N.H. 104098										
Adult female	24.5	—	—	6.0	5.5	5.4	4.3	4.5	3.8	4
A.M.N.H. 104104										
Juv. female	—	5.2	3.8	—	—	5.6	4.6	—	—	1
Upper Idenburg R.										
A.M.N.H. 151811										
Old female	24.2	—	—	6.2	5.3	5.4	4.7	4.4	4.0	5
A.M.N.H. 151847										
Adult female	25.1	—	—	6.0	5.2	5.3	4.5	4.8	4.2	4

TABLE 4

Comparison of Tooth Measurements of Types and Paratypes of the *Phalanger vestitus* Group

	p^4–m^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^2	W. m^2	L. m^4	W. m^4	Growth Stage
Type of *P. vestitus* Paris 1477 Juv. male	—	—	—	5.7	3.8	5.2	4.2	—	—	2
Type of *P. carmelitae* Genoa C.E. 10455 Adult female	25.5	—	—	6.1	5.0	5.6	4.3	4.6	4.6	4
Paratypes of *P. carmelitae*										
Genoa C.E. 10456 Adult male	25.1	—	—	5.7	4.5	5.2	4.5	4.6	4.1	4
B.M. 97.8.7.87 Adult male	24.8	5.0	4.4	6.1	4.8	5.4	5.0	4.4	3.9	4
Type of *P. coccygis* B.M. 28.10.1.17 Adult male	26.5	5.0	4.3	6.2	4.8	5.9	4.8	5.0	4.3	4
Type of *P. sericeus* B. M. 5.11.28.23 Adult male	25.1	5.0	4.3	6.1	4.3	5.9	4.5	4.5	4.5	4
Weyland Mts.										
Berlin (field No. 598) Adult male	24.6	4.6	4.2	5.9	4.5	5.4	4.8	4.3	3.9	4
Berlin (field No. 581) Adult male	24.8	5.0	4.2	6.0	4.6	5.6	4.8	4.4	3.9	4

TOOTH SIZES IN *Phalanger vestitus* AND ALLIES

Series from Central Ranges near Port Moresby

	p^1–m^4	L. mp^4	W. mp^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Growth Stage
Mt. Tafa										
A.M.N.H. 104091 Adult male	24.5	—	—	3.9	3.2	5.4	4.4	4.5	4.1	4
Wharton Range (Murray Pass)										
A.M.N.H. 104093 Adult male	24.4	—	—	4.2	3.8	6.0	4.8	4.9	4.4	5
A.M.N.H. 104095 Adult male	26.0	—	—	4.5	4.1	5.9	4.3	5.1	4.6	4
Mt. Tafa (*carmelitae*)										
A.M.N.H. 104110 Adult male	24.1	—	—	4.5	4.5	6.0	4.5	4.5	4.3	4
A.M.N.H. 108563 Adult male	24.5	—	—	4.3	4.5	5.6	4.5	4.8	4.2	5
A.M.N.H. 108565 Adult male	25.4	—	—	4.6	4.5	5.9	4.2	5.0	4.2	4
A.M.N.H. 108567 Adult male	23.5	—	—	4.6	4.5	5.3	4.4	4.6	4.1	5
Series from the Mt. Wilhelmina Area										
A.M.N.H. 109484 Adult male	23.1	—	—	4.8	4.5	5.3	4.3	4.5	3.8	5
A.M.N.H. 109489 Adult male	24.6	—	—	5.0	4.5	5.8	4.5	5.0	3.8	4
A.M.N.H. 109491 Adult male	23.8	—	—	4.6	4.1	5.7	4.3	4.6	3.9	4
A.M.N.H. 109490 Old adult male	23.5	—	—	4.2	3.9	5.6	4.3	4.5	4.3	5
A.M.N.H. 109494 Adult male	24.3	—	—	4.7	4.3	5.7	4.4	4.5	3.9	4
A.M.N.H. 109492 Adult male	25.0	—	—	4.3	4.1	6.2	4.1	4.8	4.0	4
A.M.N.H. 109493 Adult male	23.5	—	—	4.8	4.7	5.3	4.0	4.5	4.0	4
A.M.N.H. 109497 Juv. male	—	4.7	3.9	—	—	5.8	3.9	—	—	2
A.M.N.H. 109495 Adult male	23.5	—	—	5.0	4.5	5.4	4.0	4.8	4.0	4
A.M.N.H. 109496 Adult male	24.5	—	—	4.9	4.7	5.5	4.0	4.6	3.6	4
Average	24.5	—	—	4.5	4.0	5.8	4.4	4.8	4.1	

TABLE 6

Analysis of Jentinck's (1885, pp. 112–118) Data on *Phalanger maculatus*

	Number of specimens			
	Male		Female	
	Young	Adult	Young	Adult
Phalanger m. maculatus				
Biak, Geelvink Bay	—	1	—	—
Miosnom, Geelvink Bay	—	—	—	1
Japen (Jobi, Ansus), Geelvink Bay	—	—	—	3
Mafoor (= Numfor)	—	—	—	1
Sorong, western Vogelkop	—	3	—	1
Warbusi, near Wariap, south of Manokwari	—	1	—	—
Phalanger with "sooty" spots in both sexes				
Waigeu	1	3	—	2
Batanta	1	—	females spotted ?	
Misol	2	1		
Japen	—	1		
Phalanger females with black back, unspotted				
Miscl	—	—	—	2
Phalanger with chocolate spots as in *chrysorrhos*				
Ceram	1	1	—	—
Amboina	3	5	—	—
Kei (with Khoor)	1	—	—	—
Aru	1	1	—	—
Triton (= Lobo) Bay	1	—	—	—
Saleyer, south of Celebes	—	1	—	—
Phalanger chrysorrhos (females only, with lateral line)				
Amboina	—	—	2	4
Padjang, southeast of Ceram	—	—	—	1
Andai, Vogelkop	—	—	—	1
Saleyer, south of Celebes	—	—	1	2
Aru	—	—	—	2
Phalanger females, black backed, "without lateral line," similar to our material from south New Guinea	—	—	1	—

TABLE 7

MEASUREMENTS OF *Phalanger m. maculatus*

	No. Spec.	Total Length	Tail Length	Hind Foot Length	Cond.-basal Length	Zygomatic Breadth	Growth Stage
Cyclops Mts. and Hollandia	3 ♂	(660–741)	(320–382)	(55–71)	(66–80)	(42–52)	2
		700	350	63	73	48	
	1 ♂	1140	570	87[a]	102	70	4
	1 ♂	1108	520	80[a]	107	75	5
	1 ♀	538	271	48	60	37	1
	6 ♀	(628–777)	(320–395)	(57–64)	(66–76)	(42–48)	2
		700	355	60	71	45	
	4 ♀	(1160–1204)	(550–595)	(83–90)	(105–108)	(67–73)	4
		1180	575	86	106	70	
	1 ♀	1250	605	95	107	78	5
Upper Idenburg R.	1 ♂	545	264	52	—[b]	—[b]	1
	1 ♂	—	—	—	68	51[c]	2
	6 ♂	(753–775)	(355–358)	(62–66)	(79–87)	(46–64)	3
		765	357	64	83	50	
	3 ♂	(950–980)	(445–455)	(75–81)	(94–96)	(63–69)	4
		965	450	78	96	66	
	1 ♂	995	455	78	96	67	5
	1 ♀[d]	624	290	54	—[b]	—[b]	1
	2 ♀	(611–672)	(285–320)	(53–59)	(65–67)	42	2
		641	302	56	66		
	2 ♀	850	395	71	(87–88)	(55–56)	3
	1 ♀	—	—	—	96	61	4
	5 ♀	(1057–1105)	(470–505)	(75–85)	(98–102)	(65–67)	5
		1080	480	80	100	66	

[a] The skins of these two males appear to have had the labels exchanged.
[b] Skull broken.
[c] No skins.
[d] Dentition slightly advanced beyond normal of group.

TABLE 8

Measurements of *Phalanger m. chrysorrhos* from South New Guinea

No. Spec.	Total Length	Tail Length	Hind Foot Length	Cond.-basal Length	Zygomatic Breadth	Growth Stage
2 ♂	(390–452)	(180–225)	(40–42)	52.5	(32–32.5)	1
	420	205	41		32	
2 ♂	(640–755)	(290–352)	(50–64)	(65–77)	(42–48)	2
	700	320	57	71	45	
5 ♂	(740–860)	(360–401)	(63–72)	(82–89)	(51–53)	3
	800	380	67	85	52	
5 ♂	(945–1010)	(450–493)	(70–81)	(93–101)	(61–67)	4
	960	470	76	97	64	
5 ♂	(1040–1350)	(490–510)	(80–90)	(100–105)	(67–74)	5
	1190	500	85	102	70	
1 ♀	348	155	33	47.5	30	1
4 ♀	(570–648)	(272–309)	(47–60)	(61–70)	(39–45)	2
	610	290	53	65	42	
1 ♀	920	425	76	90	54	3
5 ♀	(970–1030)	(445–490)	(73–81)	(96–102)	(62–65)	4
	1000	465	77	99	63	
5 ♀	(950–1070)	(430–485)	(73–77)	(96–105)	(61–67)	5
	1010	460	75	100	64	

TABLE 9

Dimensions of *Phalanger m. nudicaudatus*

	p^4–m^4	Crown Length i^2	L. mp^4	W. mp^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Total Length Skin	Tail	Hind Foot (c.u.)	Growth Stage
P. nudicaudatus														
Type, B.M.51.1.11.17 Juv. female	—	3.2	5.1	4.1	—	—	6.8	5.0	—	—	—	—	—	1
B.M. 23.12.16.33 Adult female	30.1	3.5	—	—	5.7	5.2	6.3	5.1	6.0	4.8	—	—	—	4
M.C.Z. 29271 Adult male	28.0	2.7 (worn)	—	—	5.1	5.0	6.3	4.9	5.4	4.9	857 mm.[a]	415	80	4
P. ochropus														
Type, B.M. 66.4.23.4 Adult female	26.5	worn	—	—	4.8	3.9	6.3	4.9	5.1	4.2	—	—	—	5

TABLE 10

Dental Measurements in *Phalanger ursinus* and Allies

	p^4–m^4	i^3	L. mp^4	W. mp^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Cond.-basal Length	Zyg. Width	Growth Stage
Cotypes of *P. ursinus*													
Leiden a													
Old adult male	—	—	—	—	6.0	4.4	7.0	5.5	—	—	105.0	67 0	5
Leiden b													
Young adult ?	—	—	—	—	6 3	5.1	7.0	5.3	—	—	86 0	56 0	3
Leiden c													
Juvenal ?	—	—		—	5.7	4.6	7.4	5.3	—	—	—	—	3
B.M. 44.3.2 2													
Young female (former Leiden cotype)	—	3.0	—	—	—	—	—	—	—	—	—	—	4
Also from N. Celebes													
Buitenzorg 2802													
Young adult male	32.0	3.1	—	—	5.9	5.1	7.1	5.6	5.5	4.9	98.0	67.5	4
Buitenzorg 2741													
Young adult female	32.5	3.0	—	—	6.3	5.4	7.0	5 6	5.2	4.7	91.0	55 5	4
Buitenzorg 2800													
Young adult female	32.0	2.7	—	—	6 0	4.9	7.1	5.3	5.3	4.8	98 0	64 0	4
Buitenzorg 2803													
Young adult female	32.0	2 8	—	—	6.0	5.2	7.0	5.5	5.7	4.9	95 0	62.0	4
A.M.N.H. 152884													
Young adult female	30.0	3.1	—	—	5 8	4.6	6.7	5.3	5.0	4.7	96 0	66.0	4
Peleng Islands													
A.M.N.H. 10894													
Young adult male	30.4	3.2	—	—	5.5	4.8	7.2	5.2	4.9	4 2	92 0	59 0	4
A.M.N.H. 109233													
Young adult male	30.5	2.8	—	—	5 6	4.7	7.0	5.2	5.4	4.5	87.5	54.5	4
A.M.N.H. 108791													
Juvenal male	—	3.0	—	—	5.5	4 5	7.0	5 2	—	—	80 0	49 5	3
A.M.N.H. 108801													
Juvenal male	—	2 7	4.4	3.2	—	—	7.0	5 5	—	—	72 0	44 0	2
A.M.N.H. 108769													
Adult female	30 7	2 7	—	—	5 7	4 7	7 3	5 4	5.4	4.6	93 5	59 0	4

TABLE 10 (*Continued*)

	p^4–m^1	i^3	L. mp^4	W. mp^4	L. p^1	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Cond.-basal Length	Zyg. Width	Growth Stage
A.M.N.H. 108800													
Juvenal female	—	2.9	4.2	3.0	—	—	7.2	5.3	—	—	72.0	45.0	2
A.M.N.H. 108795													
Juvenal female	—	2.8	4.9	3.4	—	—	7.3	5.4	—	—	75.5	46.0	2
Type of *P. furvus*													
Adult male	34.2	—	—	—	—	—	—	—	—	—	101.5	66.2	5
Also from Middle Celebes													
Buitenzorg 2568													
Young adult male	31.8	3.9	—	—	6.3	5.4	7.2	5.7	5.6	5.2	91.0	59.0	4
South Celebes													
A.M.N.H. 100981													
Adult female	31.8	3.6	—	—	6.4	5.4	7.4	5.9	5.6	5.2	102.0	69.8	4
A.M.N.H. 100982													
Adult female	33.8	4.0	—	—	6.4	5.7	7.6	5.9	6.2	5.4	104.0	68.0	4
Type of *P. togianus*													
A.M.N.H. 153377													
Young adult male	31.0	3.9	—	—	6.2	5.0	6.7	5.7	5.5	4.7	93.0	62.0	4
Paratypes *togianus*													
A.M.N.H. 153381													
Young adult male	30.5	3.8	—	—	6.0	5.1	6.5	5.2	5.8	4.6	96.0	59.0	4
A.M.N.H. 153374													
Young adult male	30.5	3.7	—	—	5.9	5.3	6.8	5.7	5.4	4.4	91.0	59.0	4
A.M.N.H. 153370													
Young male	30.7	3.8	—	—	6.2	5.2	7.0	5.2	5.3	4.8	88.0	57.0	4
A.M.N.H 153371													
Young male	30.7	4.1	—	—	5.8	5.4	7.0	5.5	5.4	4.4	87.0	55.5	4
A.M.N.H. 153365													
Adult male	30.5	3.7	—	—	6.4	5.2	6.7	5.4	5.7	4.8	99.0	63.0	4
A.M.N.H. 153359													
Adult male	30.7	3.9	—	—	6.8	5.6	—	—	5.4	4.7	97.0	62.0	4
A.M.N.H. 153375													
Adult female	31.2	3.4	—	—	6.1	5.3	7.1	6.2	5.7	4.9	96.0	62.5	4
A.M.N.H. 153373													
Young adult female	31.0	3.4	—	—	6.2	5.7	7.0	5.7	5.8	4.9	94.0	62.5	4

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RESULTS OF THE ARCHBOLD EXPEDITIONS. NO. 53

A REVIEW OF THE ELAPID GENUS *ULTROCALAMUS* OF NEW GUINEA

By Charles M. Bogert and Bessie L. Matalas

The genus *Ultrocalamus* was proposed by Sternfeld in 1913, with two forms recognized. The species *preussi* was designated type of the genus, and an additional name, *bürgersi*, was proposed on the basis of a poorly preserved specimen from "Deutsch-Neuguinea." Since 1913 a third "species," *latisquamatus*, has been described by Schüz, and at least 18 additional specimens assigned to *preussi* have been partially described or mentioned in print.

This review is prompted by the acquisition of six additional specimens secured by the Archbold Expeditions for the biological exploration of New Guinea. The expedition of 1936–1937, an account of which is provided by Rand and Brass (1940), obtained two specimens south of the main divide, near Palmer Junction on the upper Fly River, and four specimens on the Idenburg River were secured by the expedition of 1938–1939 (summarized by Archbold, Rand, and Brass in 1942). A survey of the literature reveals that all specimens hitherto reported were taken on the northern slope of the island (see map, fig. 7). Thus the two specimens from the Fly River extend the known range of the genus, and, moreover, they appear to represent an undescribed form. Before comparisons can be made, however, it becomes necessary for us to evaluate the variations in *preussi*, with which we synonymize both *bürgersi* and *latisquamatus* for reasons explained below. Because we believe the specimens taken on the southern drainage represent a new subspecies the name of the type species becomes a trinomial.

Ultrocalamus preussi preussi Sternfeld

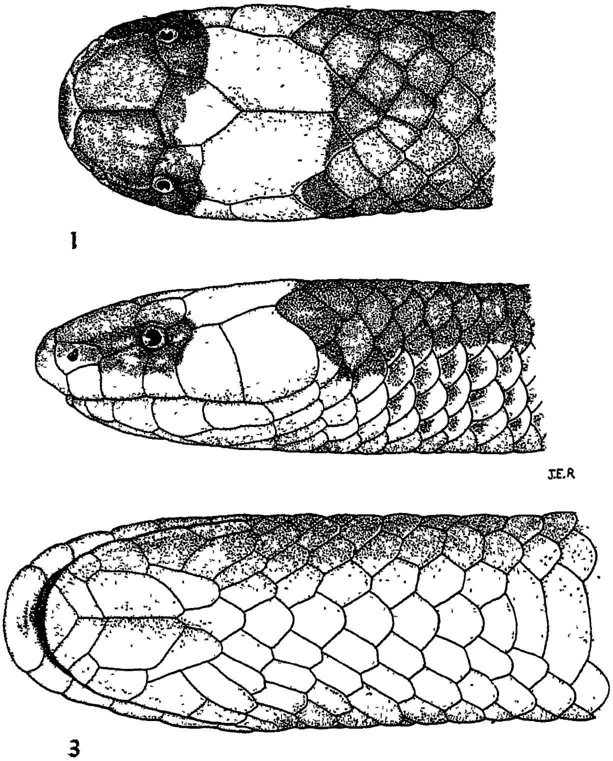
Ultrocalamus preussi Sternfeld, 1913, p. 388, figs. 1–2 (Seleo Island, near Berlinhafen, type locality); Sternfeld, 1914, p. 38, figs. 31–32 (description of specimen reported in 1913 repeated); de Rooij, 1917, p. 258, figs. 99–102 (Sermowai River, Humboldt Bay; Njao on Tjano River); de Rooij, 1919, p. 93, figs. 7–10 (upper Sermowai River, lower Sermowai River; Njao on the Tjano River; and Hollandia. Except for the latter locality, de Rooij's 1917 records are evidently repeated here); de Jong, 1927, p. 306 (Etik, Biri River; Arso, Prauwenbivak; Pionierbivak); Schüz, 1929, p. 15 (Teiau River, Toricelli Mountains); de Jong, 1930, p. 407 (Mamberamo River at 50 meters; Albatrosbivak on the Mamberamo River).

Ultrocalamus bürgersi Sternfeld, 1913, p. 388 ("Deutsch-Neuguinea," type locality).

Ultrocalamus latisquamatus Schüz, 1929, p. 15 (Garub or Garup River, Toricelli Mountains, type locality).

Material Examined: Four specimens from 4 kilometers southwest of Bernhard Camp, Idenburg River, at an elevation of 850 meters, in Netherlands New Guinea (A.M.N.H. Nos. 62469–62472), collected by William B. Richardson while he was attached to the Indisch-Amerikaanische Expeditie of 1938 and 1939.

Lepidosis: Dorsal scale row formula 13–13–13 on three males but alternating between 13 and 15 on the single female because the vertebral row or the sixth row repeatedly merge and then separate from the contiguous rows. Ventrals 292, 295, 298 (males), 331 (female); anal plate single; caudals 46, 47, 54 (males), 20 (female). Supralabials uniformly five, with the second and third reaching the eye, and with the fifth widely separated from the postocular (see fig. 2), except on A.M.N.H. No. 62472 where the anterior corner reaches the postocular. Infralabials six throughout the series, with the first three in contact with the anterior chin shields. Nasal entire, in contact with the first and second labials. Postocular present on both sides of all specimens. Ratios of width to length in the dorsal head scales are as follows: prefrontal .86 to 1.9, frontal .61 to .81, supraocular .77 to 1.1, parietal .53 to .63.



Ultrocalamus p. preussi

Figs. 1–3. Dorsal, lateral, and ventral views of the head of *Ultrocalamus p. preussi*, A.M.N.H. No. 62470 (male, × 5).

Dentition: Maxillary teeth II + 4; palatine teeth 6, pterygoid teeth 16; dentary 12. Grooves are present on all maxillary teeth, including the tubular fangs. Functional fang 0.8 mm. from entrance lumen to tip on a specimen 505 mm. in total length.

Hemipenes: On the three males the organ (*in situ*) extends to the nineteenth, seventeenth, and seventeenth caudals, respectively, with the organ as well as the sulcus bifurcating in the region of the fifteenth caudal. Basal portion with spines arranged in longitudinal rows terminating in spinules. Distal lobes with papillae arranged in diagonal rows comprising seven chevrons.

Dimensions: Males 500, 505, and 563 mm. in length, with the tails respectively 64, 57, and 64 mm. Female 414 mm., tail 17 mm. Ratios of tail to total length .11 to .13 in males, .04 in the female.

Coloration: Dark brown above, the two outer scale rows lighter, with a dark spot in the center of each scale. Underside dirty white with a brown bar on each ventral and each caudal, except on A.M. N.H. No. 62470 on which bars are absent from many ventrals. A cream-colored band is present in the parietal region, extending onto the labials as depicted in figures 1 and 2. The tail terminates in a cream-colored, blunt scale.

SEXUAL DIMORPHISM: It will be noted above that in proportion to the total length the tails of males are approximately three times as long as those of the female. Similarly, the female possesses fewer than half as many caudals and more than 30 additional ventral scales. Two males possess whitish supracloacal tubercles, but these are absent from the largest male as well as from the female. Despite their absence from the largest male, they presumably represent male secondary sex characters.

REMARKS: Heretofore the sex of the few specimens described in the literature has not been mentioned, although de Rooij (1917) evidently had both sexes represented as indicated by the extremes in ventral and caudal counts which she lists as 300 to 328, and 16 to 48, respectively. The counts for seven specimens listed by de Jong (1927) indicate that all specimens but one with 283 ventrals in his series were females. Similarly the types of *preussi* and *latisquamatus* evidently were females, indicating a range in ventral counts of 307 to 331 for females and from 283 (*fide* de Jong, 1917) to 300 for males, assuming that de Rooij's minimum count represents a male. Caudals vary from 16 to 29 in females, if the minimum count reported by de Rooij is correct, and from 37 to 54 in males. Owing to the blunt termination on the tail of all specimens, it is almost impossible to determine whether portions of the tail may not have been lost in some specimens.

The presence of both 15 and 13 scale rows on the female described above throws considerable doubt on the validity of 15 scale rows as a diagnostic character for *bürgersi* and *latisquamatus*. Neither can much value be attributed to the absence of a postocular, because one specimen of the form reported below lacks this shield on one side. Four supralabials quite possibly represent an abnormality resulting from the fusion of two labials. Schüz (1929) presumes that differences in the proportions of the head shields are of diagnostic significance, but had he bothered to convert his measurements to ratios he himself would not have discovered any impressive difference. Ratios for various head shields are presented above in order to indicate the amount of variation present on our small series. Moreover, the presence of *preussi* in the Toricelli Mountains, as reported by Schüz, would indicate that two closely related "species" occur side by side. Because the characters assumed to be diagnostic for *latisquamatus* and *bürgersi* may well represent mere abnormalities, we conclude that specimens rather than species were defined, and that the names are synonyms of *preussi*.

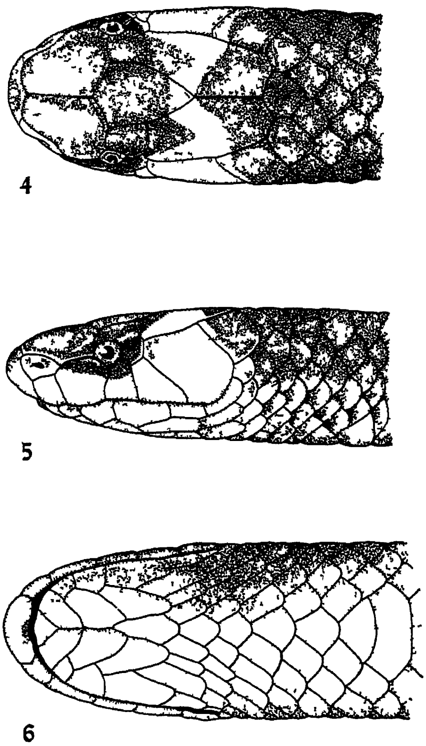
On the other hand the two specimens taken by the Archbold Expedition of 1936–1937 differ in several respects from specimens hitherto described, particularly when the difference between the sexes in *U. p. preussi* is taken into account. The most obvious character which serves to distinguish the specimens secured south of the main divide is a much narrower, more irregular band across the parietal region. Accordingly we propose to call the population represented by these two specimens

Ultrocalamus preussi angusticinctus, new subspecies

TYPE: A male specimen, A.M.N.H. No. 57512, taken on the upper Fly River, 5 miles below Palmer Junction in the Western Division of Papua, by Richard Archbold, Austin L. Rand, and G. H. H. Tate in May, 1936.

DIAGNOSIS: Closely related to *U. p. preussi* from which it differs in possessing more ventral scales, and a relatively shorter tail (in males and presumptively in females as well), a narrower parietal band, and in having the fifth supralabial in broad contact with the postocular when this scale is present.

DESCRIPTION OF THE TYPE: Dorsal scale row formula 13–13–13. Ventrals 312; anal plate single; caudals 43. Cephalic plates as depicted in figures 4 to 6, with no preocular and postoculars 1-1. Supralabials 5-5, with the first reaching the nasal, the second touching both the nasal and the eye, and with the third, fourth, and fifth all in contact with the postocular. Infralabials 6-6, the first pair meeting on the midline behind a normal mental. Two pairs of chin shields approximately of equal length, the posterior pair completely separated by a single scale that extends forward to separate the posterior ends of the first pair. Ratios of width to length for the head shields are: prefrontal .86, frontal .65, supraocular .82, parietal .57.



Ultrocalamus p. angusticinctus

Figs. 4–6. Dorsal, lateral, and ventral views of the head of *Ultrocalamus p. angusticinctus*, A.M.N.H. No. 57512 (male, type, × 5).

Dentition: Only the maxilla was examined. It contained two fangs followed by four solid grooved teeth, decreasing in size from front to back (see fig. 8), all of them with grooves. The fang is 0.6 mm. from entrance lumen to tip.

Hemipenis: As dissected *in situ* the organ extends to the fifteenth caudal, bifurcating at the thirteenth, with the sulcus spermaticus dividing at the twelfth caudal. Basal portion with thickly set spinules in longitudinal rows. Distal lobes with papillae tipped with spinules arranged in diagonal rows comprising seven chevrons.

Dimensions: Length over all 477 mm., the tail (42 mm.) 8.8 per cent of the total length.

Coloration: Dark brown above, the two outer scale rows with light margins on the scales. Underside dirty white, with a brown bar on most of the ventral scutes but absent on those of the anal region as well as on the neck. Tail terminating in a cream-colored, blunt scale.

Paratype: A male taken in the same locality and in the same month as the type is virtually identical in most characters. It differs from the type in lacking a postocular on the right side so that the fifth labial is in contact anteriorly with the third and fourth labials, as well as with the supraocular. On the left side of the head the fifth labial reaches a small postocular. There are 319 ventrals and 42 caudals. Ratios of the width to length of the prefrontal 1.0, of the frontal .60, of the supraocular 1.0, of the parietal .58.

Differences Between the Subspecies

The differences between *angusticinctus* and the typical form are summarized on page 5:

The data in the tabulation include those derived from the material at hand as well as those taken from the literature for *U. p. preussi.* Ventral counts listed by various authors who have not given the sex of their specimens have been placed as males or females on the basis of the data derived from our specimens where the sex is known. We have assumed that the minimum and maximum ventral counts given by de Rooij (1917) represent male and female, respectively, whereas the reverse was assumed to be true of the caudal counts. Judging by our data, all the counts listed by de Jong (1930) are those of females.

De Rooij states that the yellowish

	U. p. preussi	*U. p. angusticinctus*
1. Ventrals:		
Males	293.5 (283–300)	315.5 (312–319)
Females	319.0 (307–330)	....
2. Ratio, width of nuchal band to parietal suture length	.72 (.41–1.1)	1.9 (1.6–2.1)
3. Ratio, tail to total length:		
Males	.13 (.12–.15)	.09 (.08–.09)
Females	.05 (.04–.06)	....
4. Fifth labial	Excluded from postocular or in narrow contact	In broad contact with postocular, or supraocular

band across the parietals disappears with age, although there is no evidence of this in our material. However, the maximum length (720 mm.) which she reports exceeds our largest specimen by 210 mm.

Whereas some of the differences indicated in the table are dichotomous, it is a reasonable assumption that specimens intermediate in some characters will be found, or that only mean differences will prove to exist when large series become available from both slopes of the Snow Mountains. Evidently this range of mountains (see map, fig. 7) serves as an isolating barrier, although it is conceivable that intermediate or intergrading populations will be found at the west end of the island where the Snow Mountains terminate. Consequently we prefer to use the trinomial for *angusticinctus*, with the belief that it conveys suitable implications concerning relationships.

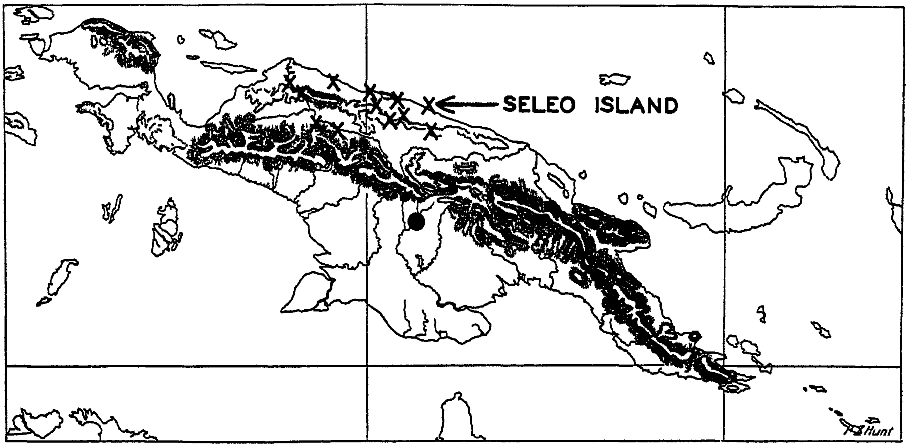
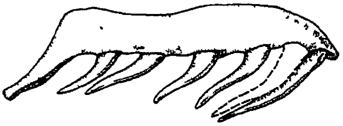


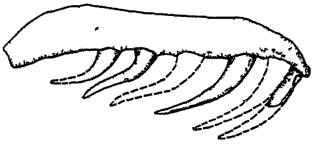
Fig. 7. Map of New Guinea, showing locality records for *Ultrocalamus*. *U. p. preussi*, ×. *U. p. angusticinctus*, ●.

GENERIC AFFINITIES

Ultrocalamus evidently is closely related to *Toxicocalamus*, *Apistocalamus*, and *Pseudapistocalamus*, all of New Guinea, as well as to *Ogmodon* of the Fiji Islands. In fact, it is doubtful whether those in New Guinea cannot all be assigned to a single genus. Boulenger in his "Catalogue of snakes" seems to have considered any modification of the head shields to be of generic importance, and his example has been followed by many other taxonomists. Because the Elapidae apparently are an ancient, relatively conservative group it is perhaps reasonable to expect it to include a fair number of monotypic genera. On the other hand, the generic category has been widely used as a means of indicating differences, whereas it was Linneaus' intention that it be used to indicate similarities. Differences are properly indicated by assigning closely related but non-interbreeding populations to separate species comprising a genus.

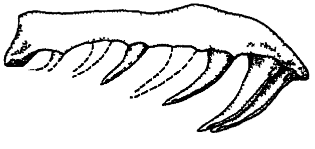


Ultrocalamus p. angusticinctus



Pseudapistocalamus nymani

10



Toxicocalamus stanleyanus

Figs. 8–10. Lateral views of the right maxillae of *Ultrocalamus p. angusticinctus*, A.M.N.H. No. 57512, type, *Pseudapistocalamus nymani*, A.M.N.H. No. 59067, and *Toxicocalamus stanleyanus*, A.M.N.H. No. 59063 (all × 15).

It may be observed that the pattern and coloration are similar on all five genera mentioned above. Moreover, there are no striking differences in dentition, whereas these five genera are unique among the Elapidae in lacking a diastema behind the fangs (figs. 8 to 10). The solid maxillary teeth vary in number from three, reported for *Apistocalamus*, to six in *Ogmodon*. Four are present in *Pseudapistocalamus*, and the same number are reported for *Toxicocalamus*, although five are present in the single specimen available of *T. stanleyanus* (A.M.N.H. No. 59063, from Mafulu, Central Division, British Papua).

Thus the total number of maxillary teeth varies from five to eight, with all intermediate stages represented. In a similar fashion the number of scale rows has been reduced in some forms, with 17 in *Ogmodon*, 17 or 15 in *Toxicocalamus*, 15 in *Apistocalamus* and *Pseudapistocalamus*, and 15 or 13 in *Ultrocalamus*. Nasal plates have become divided or coalesced in various forms, and the anal plate has been similarly affected. The temporal shields have been reduced in *Ogmodon*, and in *Ultrocalamus* they are completely lacking, along with the internasals and the preocular. Snakes referred to *Apistocalamus* reputedly possess vertically elliptical pupils, but this is perhaps open to question owing to the difficulties encountered in the determination of pupil shapes in preserved specimens.

No serious doubt can exist concerning the affinities of these snakes. They must have descended from a single ancestral population, and some features of their anatomy suggest that it may have been from a relatively primitive elapid stock (Bogert, 1943, p. 297). Evolution has proceeded along various lines with one structure being lost in one species and retained in another. Whether the burrowing habits, which presumably characterize all these snakes, have in some manner brought about the reductions in scalation or not we can only speculate. However, if the ancestral stock had adopted subterrestrial habits while imperfectly adapted for this mode of existence, a premium may have been placed on a slender habitus. Assuming that selective forces were involved, it is probable that the loss of one scale or another was purely incidental to the attainment of a slender body. Hence the coalescence of contiguous scales or scale rows, or the loss of individual scales, may have been purely a matter of random selection. Genetic isolation of five strains is indicated, and, in general, specialization seems to be most advanced in *Ultrocalamus* which has lost the internasals, as well as the temporals, while the nasals and the anal plates have become fused. But various stages in these reductions are indicated in other strains that we now recognize as "genera." It is doubtful whether each of these groups will not prove to be monotypic when enough material is available to evaluate the supposed differences that have been pointed out. Usually diagnoses were prepared upon the basis of fewer than a half dozen specimens, with no mention of sexual dimorphism. No striking differences, for example, are apparent when the characters of the five nominal species of *Apistocalamus* are plotted, and it is questionable whether even five valid subspecies are represented.

Additional material may become available as the result of the current occupation of New Guinea by American armed forces which include several naturalists. While pointing out the desirability of assembling these several related species in one genus, more extended studies are desirable before the precise taxonomic status of the various forms can be ascertained. Hence we retain the various generic names pending further study.

MAXILLARY DENTITION IN PRIMITIVE ELAPIDS

Despite their specialization in other characters, *Ultrocalamus* and its relatives may be regarded as primitive in some aspects of their maxillary dentition, particularly in the feeble enlargement of the fangs. In the majority of elapids the fangs are relatively enormous in contrast with the solid teeth on the maxillae, and in many genera only the tubular fangs remain, always in paired sockets to permit replacement of one fang while the alternate one is in use (Bogert, 1943). But in *Ultrocalamus* and its relatives the teeth gradually diminish in size from front to back, and the solid teeth are near replicas of the fangs. However, only the two anterior teeth are tubular with the suture or weld in the venom canal running from the entrance lumen to the discharge orifice. Curiously enough, a groove similar to that on the true fangs is present on each solid tooth as well, and on some teeth there are concavities in the respective positions of the entrance lumen and the discharge orifice that conceivably represent vestiges of a venom canal. These were evidently so conspicuous on the type specimen of *Ogmodon* that Peters (1864, fig. 4d, 4c) depicted all eight teeth as though they were tubular fangs.

Similar grooves are present on the solid teeth of other elapids. These grooves, of course, may have no phylogenetic significance, but it may be suggested that they represent traces of fang structures that were actually functional in the ancestral stock. If so the two anterior teeth have become more highly specialized for the conduction of venom while the posterior teeth have degenerated and in the most highly specialized elapids have been completely lost. The retention of relatively large solid teeth behind the fangs in *Ultrocalamus* and its close allies is probably coupled with the meager enlargement of the fangs (Bogert, 1943, p. 330). The diastema in other elapids is apparently present in order to provide the necessary space on the inner side of the jaw for teeth in the replacement series. In *Ultrocalamus* sufficient space is present to accommodate the replacement series of both the small fangs and the non-specialized teeth.

In proportion to the total length, *Ultrocalamus* has the shortest fangs of any elapid known, and it is extremely doubtful whether it is dangerous to man. De Jong (1927, p. 306) says that "Apparently it is a very common species" and he quotes Mr. Gjellerup who says, "according to the Papuas this snake is harmless." The stomachs of all the specimens examined by us were empty, but a somewhat larger relative, *Pseudapistocalamus nymani* (A.M. N.H. No. 59067, from Mafulu, Central Division), contained a sarcophagid fly larva (identified by Dr. Howard C. Curran). It may be presumed that most of these exiguous elapids are insectivorous.

Ogmodon, which retains more scale rows and more maxillary teeth than any other snake in the assemblage, is probably the most primitive. Its isolated position on the periphery of the range of the family tends to confirm this assumption. Other elapids have more teeth on the maxilla, but on all of them the fangs are proportionately larger than the solid teeth and set off from them by a diastema.

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TWO ADDITIONAL RACES OF THE PATCH-NOSED SNAKE, *SALVADORA HEXALEPIS*

BY CHARLES M. BOGERT

INTRODUCTION

Some years ago an attempt was made to determine the affinities and distributions of the various populations composing the genus *Salvadora*. The results of this survey (Bogert, 1939a) proved to be highly inadequate. Subsequent emendations have appeared in the papers by Smith (1941), by Bogert (1939b), by Schmidt (1940), and by Hartweg (1940). As far as the species *hexalepis* is concerned, the most important paper is that of Schmidt who recognized the specific distinctness of *Salvadora hexalepis* and pointed out my error (Bogert 1939a) in considering the populations of *hexalepis* surrounding isolated populations of *S. grahamiae* to be intergrades between the two species. Schmidt recognized these "intergrades" as a subspecies of *hexalepis* which he described as *Salvadora hexalepis deserticola*. This interpretation is undoubtedly correct, although Schmidt's concept of the range of *deserticola* was inadequate.

Stimulated by these corrections, I have undertaken a second revision of the genus. Much additional material has become available, some of it from critical regions. In fact, over twice as many specimens have been tabulated, with welcome additions from nearly all parts of the range of the genus. This new material has thrown doubt upon the locality data of a few older specimens that led to misguided notions published in 1939. It has also made it possible to re-evaluate the significance of characters either neglected or erroneously assessed in previous papers, and to outline the ranges of species as well as subspecies with greater completeness.

In the revision now in preparation considerable attention will be devoted to clines or geographical gradients. Little emphasis will be placed on taxonomy *per se*, and the chief purpose of the present paper is to dispose of descriptions of new subspecies.

It must be added, pending detailed discussion of the clines in ventral and caudal counts, that the nature of the variation in these characters suggests that the number of ventral and subcaudal scutes, and hence the number of vertebrae in *hexalepis*, is not closely correlated with other characters. In view of these facts, the race *celeris*, described by Smith in 1941 and diagnosed as having more ventrals than *deserticola*, has been referred to the synonymy of the latter by Bogert and Oliver (1945). The ventral counts in *S. h. hexalepis* are highest in lowland populations and lowest in specimens from the foothills. A similar situation seems to exist in *deserticola*, a snake inhabiting foothills and higher valleys throughout most of its range, with the mean for ventral counts being lower than that of other subspecies. However, where its range extends onto the coastal plain in northern Sinaloa and southern Sonora, the ventral counts rise just as they do in *hexalepis* in the northwestern corner of Sonora.

On the basis of a sample composed of over 375 specimens assigned to the species *hexalepis*, the ranges of the subspecies are interpreted as mapped in figure 10, based upon "spot" maps to be published later. In connection with the map it should be noted that throughout the southern portion of the range, snakes of this species do not occur in mountain or plateau regions above 4000 feet in elevation, whereas in the Mojave Desert a few specimens have been taken at elevations slightly exceeding 6000 feet. Mountain "islands" inhabited by *Salvadora g. grahamiae* occur within the ranges of both *hexalepis* and *deserticola,* and the range of the latter also overlaps that of *Salvadora bairdi* in Chihuahua.

Statistical analyses other than simple means are not used in these preliminary descriptions, but such methods will be used to interpret data when all representatives of the genus are being considered in the survey now under way.

ABBREVIATIONS USED

Data presented herein have been drawn from material in the collection of the American Museum as well as from specimens generously lent by the institutions and individuals listed below. Abbreviations used precede the names.

A.N.S.P.	Academy of Natural Sciences of Philadelphia
A.M.N.H.	American Museum of Natural History
B.Y.U.	Brigham Young University
C.A.S.	California Academy of Sciences
C.U.	Cornell University
G.W.H.	Mr. George W. Hanley of Bakersfield, California
G.C.N.P.	Grand Canyon National Park
H.T.W.	The late Lieut. Harold T. Woodall of Long Beach, California
L.M.K.	Dr. Laurence M. Klauber of San Diego, California
M.V.Z.	Museum of Vertebrate Zoology, University of California
R.H.	Dr. Ross Hardy of Dixie Junior College, Utah
S.U.M.	Stanford University Natural History Museum
S.D.S.N.H.	San Diego Society of Natural History
U.C.L.A.	University of California, Los Angeles
U.S.N.M.	United States National Museum
U.M.M.Z.	University of Michigan Museum of Zoology
Z.N.P.	Zion National Park

To the individuals in charge of these collections and to numerous others who have lent material not used directly in the preparation of this report sincere thanks are extended. Dr. L. M. Klauber and Dr. Hobart M. Smith courteously supplied scale counts and other data used herein and to them I am especially indebted. The drawings were prepared by Mr. Dimitry Alexandroff whose careful attention to detail is gratefully acknowledged.

DIFFERENTIATION IN *SALVADORA HEXALEPIS*

As now understood *S. hexalepis* contains but three races: (1) *hexalepis,* occupying the central portion of the range of the species, from Nevada and Utah southward to Sonora and Baja California; (2) *virgultea,* with a limited range in southwestern California and northwestern Baja California; and (3) *deserticola,* inhabiting an ill-defined region at the eastern extremity of the territory occupied by the species. More intensive study indicates that two additional populations formerly included with *S. h. hexalepis,* (1) that in peninsular Baja California south of the San Pedro de Mártir Mountains, and (2) that inhabiting the arid region loosely defined as the Mojave Desert, are sufficiently well differentiated from populations in contiguous areas to warrant their nomenclatorial recognition. Accordingly they are diagnosed and described below, with ranges as indicated on the map (fig. 10).

Salvadora hexalepis klauberi,[1] new subspecies

BAJA CALIFORNIAN PATCH-NOSED SNAKE

Figures 1–4

TYPE: No. 20912 in the collection of L. M. Klauber, from Cape San Lucas, Baja California, Mexico. Collected by Fred Lewis and preserved on August 6, 1933.

DIAGNOSIS: A subspecies of *hexalepis* which differs from both *S. h. hexalepis* and *S. h. virgultea* in more commonly having two supralabials instead of one reaching the eye. Furthermore it differs from *virgultea* in having the light vertebral stripe three scales in width, and continued onto the top of the head. From *S. h. deserticola* it differs in more commonly having the loreal divided, and in having the lower lateral stripe

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[1] Named for Dr. Laurence M. Klauber whose extensive collections and writings have contributed so much to our knowledge of patch-nosed snakes in the Southwest.

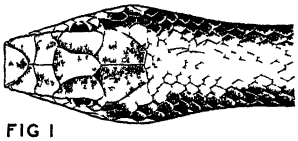

FIG 1

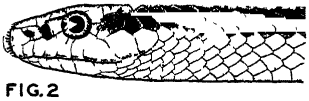

FIG.2

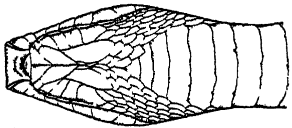

FIG.3

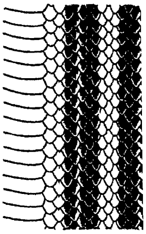

FIG.4

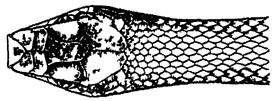

FIG.5

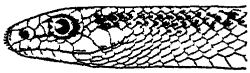

FIG.6

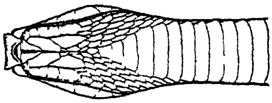

FIG.7

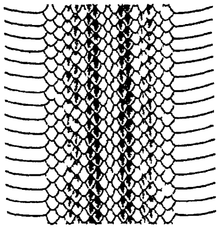

FIG.8

Figs. 1–3. Dorsal, lateral, and ventral views of the head (× 1) of the type specimen of *Salvadora hexalepis klauberi*, new subspecies.

Fig. 4. Pattern at midbody of the type specimen (not drawn to scale) of *S. h. klauberi*, characteristic of the race.

Figs. 5–7. Dorsal, lateral, and ventral views of the head (× 1) of the type specimen of *Salvadora hexalepis mojavensis*, new subspecies.

Fig. 8. Midbody pattern of the type of *S. h. mojavensis* (not drawn to scale), characteristic of the majority of specimens in the subspecies.

well defined on the third and fourth scale rows.

Description of the Type: An adult male with an over-all length of 1125 mm., with the tail (255 mm. long and not quite complete) comprising 23 per cent of the total length. The dorsal scale rows are 19–17–15–13, the first reduction resulting from the loss of the fourth row on the neck at the level of the eighth ventral. The row which then becomes the fourth row at midbody is lost at the 128th ventral (right) and at the 125th ventral (left). The seventh row is suppressed above the 132d ventral on the left and above the 128th ventral on the right resulting in the final reduction to 13 rows. The scales of the second to fifth scale rows over the anal region and on the base of the tail are strongly keeled; otherwise all dorsal scales are smooth, with vestiges of double apical pits visible on some of them. There are 201 ventrals, not including a small triangular scale at the junction with the gulars. The anal plate is divided, and the caudals number 91 with perhaps as many as 10 missing with the tip of the tail.

The scales on the top of the head include the large, recurved rostral with the lateral edges grooved and projecting, paired internasals, prefrontals, a frontal and a pair of parietals, as depicted in figure 1.

The nasals are divided, with the anterior section in contact with the second supralabial. There are two loreals on each side, the upper larger than the lower. Preoculars are 2-2, postoculars are 2-2, and there are no suboculars. The temporals are irregular but essentially 2 + 3 on the right and 2 + 2 on the left. There are nine supralabials on each side, of which the third and fourth reach the loreals, and the fifth and sixth reach the ocular. The infralabials are 11-11, the anterior three of which are in contact with the first pair of chin shields. The posterior pair of chin shields are larger than the anterior pair and separated by three scales, with an extra scale on the left as shown in figure 3.

There are 11 teeth in the right maxilla, followed after an interspace by three enlarged teeth. On the left maxilla there are 12 teeth anterior to the three enlarged teeth. The teeth in other series have not been examined on the type. One hemipenis has been removed, and on the right the organ is partly everted so that no satisfactory examination could be made.

The pattern consists of a light clay-colored vertebral stripe three scale rows in width flanked on either side by a brown stripe embracing five scale rows. The upper margins of the scales in the fourth row and the lower margins of those in the fifth are lighter so that the brown stripe is ostensibly split at midbody (fig. 4). Anteriorly, however, the light margins disappear and the two portions of the stripe are confluent at the forty-fourth ventral. The brown stripe becomes narrower on the neck and extends onto the temporal region, whereas the light vertebral band broadens to about eight scales in width on the occiput where virtually the same color extends onto the dorsal cephalic plates. Posterior to the lateral scale reduction the band is clearly divided, with the lower portion confined to the third scale row. Only the upper margin of the fourth row is brown, and the upper stripe falls principally on the fifth row, diminishing in width as it extends onto the tail. The lower portion of the stripe fades out anterior to the anus. The first scale row is immaculate on either side, but faint traces of brown are present on the second row. The ventral surface, from the mental plate to the end of the tail, is uniformly white with a faint tinge of yellow.

SUMMARY OF THE PARATYPES

SCUTELLATION: Of the specimens summarized here and listed individually below, 17 are males and 20 are females. Data drawn from the type are included because it represents part of the hypodigm.

The dorsal scale row formula is normally 19–17–15–13. However, on one female from Miraflores, the fourth row normally dropped on the neck is retained posteriorly to the ninety-first ventral, giving a midbody count of 19. On another female from Cape San Lucas there are extra rows on the neck which are carried throughout the length of the body, resulting in the formula 21–19–17–15. Two additional females retain the seventh row as far as the anus, and the resulting formula, 19–17–15, is also found on a single male, the only one of the sex abnormal in scale row reductions. The first reduction on the neck takes place between levels of the eighth and twenty-fourth ventrals on males (mean for 11 sides 12.5), and, excluding abnormal individuals described above, between the seventh and nineteenth ventrals on females (mean for 9 sides 11.8). The second reduction, that involving the suppression of the fourth row above the ventrals posterior to midbody, occurs between the 118th and 137th ventrals on males (mean 128.2 for 29 sides), and between the 121st and 138th on females (mean 131.2 for 36 sides). The ventral scales vary from 191 to 203 in males (mean 198.3 for 17 specimens), and from 192 to 204 on females (mean 197.1 for 20 specimens). The tip or more of the tail is missing on so many specimens that subcaudal counts for only 12 males and 13 females can be summarized. Males vary from 91 to 103, mean 95.7; females from 86 to 100, mean 91.6.

Supralabials are normally 9 (89.5 per cent) but 8 occur on 3.9 per cent and 10 are found on 6.6 per cent of 76 sides tabulated. On 81.7 per cent of the sides, two supralabials, usually the fifth and sixth and rarely the sixth and seventh, reach the eye. On the remaining sides only the sixth labial reaches the eye. On 92.9 per cent of the specimens the third and fourth labials reach the loreal, the third, fourth, and fifth on 5.7 per cent, and on only 1.5 per cent the second, third, and fourth are in contact with the loreal. The infralabials are more commonly 10, but 11 are present in about 40 per cent of the specimens. The loreal is divided in 88.1 per cent of the sides, usually into two scales, although three are present on 9.2 per cent of the total. Single loreal plates occur on 12.9 per cent of the sample. The preoculars and postoculars are uniformly 2-2, and one subocular is present on one or both sides of only six specimens out of 38. The total number of preoculars, postoculars, and suboculars varies from only four to five, therefore, with 89.5 per cent of 76 sides tabulated having four. The temporals are more commonly 2 + 3, but 2 + 2 are present on about 20 per cent of the specimens, and 3 + 3 sometimes occurs.

DENTITION: On 54 maxillae the formula 11 + 3 is represented on 70.4 per cent of the sample; the formula for the remainder is 12 + 3. Complete counts of all teeth have been made on four specimens with the following results: palatine teeth vary from 7 to 10 (mean 8.6), pterygoid 14 to 18 (mean 14.4), and teeth on the dentary from 15 to 18 (mean 16.1).

DIMENSIONS: The largest specimen examined is a male, from San Pedro at the south end of the peninsula, which has a total length of 1147 mm., and perhaps 10 mm. are missing from the tip of the tail. The largest female, with over-all dimensions of 1135 mm., is from La Paz, a few miles north of San Pedro. The ratio of tail to total length averages 0.23 in males with extremes of 0.22 to 0.27. For females the mean is the same, but extremes are from 0.22 to 0.24.

PATTERN: Some of the older specimens are too bleached, and a few modern specimens permitted to remain too long in formalin are so badly discolored and darkened, that they are virtually worthless for pattern characters. On most freshly preserved patch-nosed snakes from Baja California south of latitude 30° N., however, the pattern closely corresponds to that described for the type. The light vertebral stripe is uniformly three scales wide, and the brown lateral stripe is split anteriorly almost to the neck. The only exception is a specimen (L.M.K. No. 1068) from El Mármol (or Onyx Mine) just south of latitude 30° N. This specimen is slightly darker, with the lower scale rows darker than the ventral surface. The sixth supralabial reaches the orbit on the right side, and two suboculars present on the left side occlude all supralabials from the orbit. This is one of two specimens from Baja California in which the latter character occurs; it is rare in *virgultea* but present on one side of a Baja Californian specimen of the race. On the whole, therefore, the El Mármol specimen seems to be an intergrade. It is virtually identical with intergrades between *virgultea* and *hexalepis*, particularly those taken in the eastern foothills of San Diego County.

SEXUAL DIMORPHISM: As in all races of *S. hexalepis*, the strongly keeled scales in the lateral rows above the anal region are present only on mature males. Despite the fact that the means for relative tail lengths, as well as for ventral counts, are substantially the same for both sexes, the small samples indicate a difference in the mean number of subcaudals that may be statistically if not biologically significant. Also it may be noted in the summary above that the fourth scale row is retained for a mean distance of three ventrals more on females than it is on males. The largest snakes of the species occur within the range of *S. h. klauberi*, and males appear to attain greater lengths than those of the other sex. Of 18 females and 16 males that could be measured with sufficient accuracy, only one female exceeds 1100 mm. in over-all dimensions in contrast to four males that exceed this figure.

GEOGRAPHICAL VARIATION: In the material available, most of it from the cape region, there is no indication of any gradient or trend that could be detected. However, more material from the peninsula north of La Paz would be required before mean differences would become apparent.

INTERGRADATION: The transition from

virgultea to *klauberi* appears to be rather abrupt, both in pattern as well as in scale characters. The diagnostic character, consisting of two labials reaching the eye, is found on 89.5 per cent of the *klauberi* sample, whereas it occurs on but one of 11 individuals belonging to the subspecies *virgultea* from Baja California north of latitude 30° N. Intergradation with *hexalepis* presumably occurs at the northeastern corner of the range of *klauberi*. No specimens of *hexalepis* are known from Baja California, although there is every reason to believe that *hexalepis* occurs in the northeastern corner of the peninsula. A specimen from San Matias represents the easternmost record for the species in this region, but the individual is referred to *virgultea* on the basis of its low ventral count (189), the pattern being bleached beyond recognition. The El Mármol specimen mentioned above more closely resembles *klauberi* in pattern characters than it does *virgultea*. Yet the nature of the difference is such that it would be nearly impossible to distinguish *klauberi-virgultea* intergrades from *hexalepis-virgultea* intergrades, until several individuals from the critical area become available.

RANGE: The peninsula of Baja California, Mexico, from approximately latitude 30° N. southeastward to the Cape (Cabo San Lucas).

The subspecies is based upon 38 specimens including the type and paratypes with locality data as follows:

Five miles north of San Xavier Mission (L.M.K. No. 30386); San Ignacio (M.V.Z. Nos. 13565, 10670, 10671, L.M.K. No. 3827, U.M.M.Z. No. 76463); 20 miles west of Santa Rosalia (U.S.N.M. No. 37517); 3 miles south of Canipole, northwest of Loreto (L.M.K. No. 30385); Loreto (L.M.K. No. 30387); La Paz (C.A.S. No. 45958, U.S.N.M. Nos. 12637, 12637a, 12637b, 12638, M.C.Z. Nos. 37228, 37229); San Pedro (C.A.S. Nos. 45951, 45952); Buena Vista, Eureka Rancho, Palmas Bay, (C.A.S. No. 45953); Todos Santos (U.S.N.M. No. 37518, C.A.S. No. 45957); Eureka (M.V.Z. No. 11838); vicinity east of Santiago (C.A.S. No. 45954); Miraflores (U.S.N.M. No. 64581, C.A.S. Nos. 45955, 45965); Santa Anita (S.U.M. Nos. 4297, 4298); San José del Cabo (C.A.S. Nos. 45949, 45950); Cape San Lucas (C.A.S. No. 45959, U.S.N.M. No. 5347, L.M.K. Nos. 20466, 20858, 20511, 20912 type); "Baja California" (A.N.S.P. Nos. 5487, 5488).

Salvadora hexalepis mojavensis, new subspecies

MOJAVE DESERT PATCH-NOSED SNAKE

Figures 5–9

TYPE: No. 63000 in the collection of the American Museum of Natural History, taken at Deadman Point, 11.5 miles southeast of Victorville, at the south end of the Granite Mountains in San Bernardino County, California, by C. M. Bogert, June 19, 1935.

DIAGNOSIS: A subspecies of *hexalepis* distinguished from other racial populations of the species in more commonly having suboculars which prevent any supralabials from reaching the eye. Also it differs from other subspecies in having an obsolescent pattern, with less contrast in shade between the vertebral and lateral stripes, and the stripe on the third and fourth rows paler than that on the sixth and seventh.

DESCRIPTION OF THE TYPE: Adult male. Length over all 800 mm., with the tail (175 mm.) comprising 22 per cent of the total length. The dorsal scale rows are 19–17–15–13, with the fourth row dropping out on the neck at the point above the ninth (right) and tenth (left) ventrals, and the reduction to 15 resulting from the loss of the fourth row at the 125th ventral (right) and the 128th ventral (left); further reduction results from suppression of the seventh rows near the 150th ventral. Scales in the third to fifth rows above the anal region are keeled; otherwise all are smooth with vestiges of double apical pits not easily seen. The ventrals number 203, the subcaudals 94, not including four partial subcaudals on either side of the vent. The anal plate is divided. The scales on the head include the recurved rostral with lateral edges grooved and projecting (figs. 5–6), a pair of triangular internasals, a pair of larger prefrontals, a large frontal, large supraoculars, and a pair of parietals.

The nasals are divided, with the anterior section in contact with the second supralabial. The loreal is divided on both sides, with the upper portion larger than the lower. Preoculars are 2-2, suboculars 2-2, postoculars 2-2. The temporals are 2 + 3, 2 + 3. The supralabials are 9-9, with the third and fourth reaching the loreals; none of them is in contact with the eye. The infralabials are 11-11, the first four touching the anterior chin shields. The posterior pair of chin shields are separated by two scales followed by three scales.

On the right maxilla there are 11 teeth (12 on the left) slightly increasing in size posteriorly and followed after an interval by three enlarged teeth. Other teeth on the type have not been examined.

The hemipenis, examined as dissected *in situ*, extends to the twelfth subcaudal. The sulcus is single with one large and three smaller spines inserted at the level of the fourth subcaudal on one side only. Between the sixth and seventh caudals there are six spines in diagonal rows, three on either side of the sulcus when the organ is split opposite the sulcus. These are followed by spinules which merge distally with reticulated calyces having crenulated edges.

The ill-defined pattern consists of a gray vertebral stripe, three scales in width at midbody, flanked by a light brown stripe represented by scales with darker centers on the sixth and seventh rows (see fig. 8). A secondary lateral stripe, somewhat lighter in shade than the upper one, falls on the third and fourth scale rows. Anteriorly the lateral stripes merge and become faint on the neck, while the vertebral stripe, insofar as its boundaries can be determined, widens to seven scale rows in width on the occiput. Posteriorly, as a result of scale reduction, vestiges of the lateral stripes fall on portions of the fifth and sixth, and on the third scale rows, respectively. The underside is immaculate pale yellow, with the same color extending onto the lower scale row on each side.

SUMMARY OF THE PARATYPES

SCUTELLATION: Of the specimens for which the data below are summarized, 40 are males and 22 are females, while two are heads only, of which the sex cannot be ascertained. Data drawn from the type are also included. The dorsal scale formula is uniformly 19–17–15–13, with the first reduction occurring on the neck in the region between the fifth and nineteenth vertebrae, mean 8.3 on males and 10.5 on females (six of each sex tabulated). The second reduction, involving the suppression of the fourth row at midbody, occurs between the 105th and 136th ventrals on males (mean 125.6 for 62 sides) and between the 114th and 141st ventrals on females (mean 127.9 for 38 sides). The loss of the sixth or seventh rows is more erratic, and not satisfactorily tabulated owing to the fact that the row may be interrupted before being permanently suppressed. The ventrals are as follows: for males the extreme range is 194 to 208, mean 200.1; for females 191 to 208, mean 200.5. Caudals on males (tails complete on only 27 specimens) range from 82 to 98, with a mean of 92.4; on 16 females with complete tails from 80 to 95, mean 85.1. Supralabials are distributed as follows: 8 (5.7 per cent), 9 (80.5 per cent), 10 (12.2 per cent), 11 (1.6 per cent) for 123 sides recorded. On 71.0 per cent of the sides tabulated the supralabials are excluded from the ocular by suboculars; a single supralabial, usually the sixth, reaches the eye on 26.6 per cent of the sample, and on 2.4 per cent two labials reach the eye. (See table 1 for comparisons of samples representing the five subspecies of *hexalepis*.) Normally the third and fourth supralabials reach the loreals (84.4 per cent), but on 4.2 per cent of the sides tabulated the second and third are in contact with the loreals, the third only in 2.1 per cent, and the third, fourth, and fifth in 9.3 per cent. The infralabials are normally 10 or 11, usually with the first four touching the anterior chin shields.

In this subspecies the loreal is very rarely divided (0.8 per cent); more often there are two loreals (91.1 per cent), sometimes three (6.5 per cent), or uncommonly four (1.6 per cent). On 92.8 per cent of the sides there are two preoculars, sometimes three (6.3 per cent), and a single preocular is present in one side of one specimen. The number of suboculars varies from zero to three, but usually there are two. The postoculars vary from two to four, with the vast majority (92.8 per cent) having two. Because the suboculars occlude the labials from the eye, and because it is sometimes an arbitrary decision whether individual scales are called suboculars, it is convenient to tabulate the total number of oculars in comparisons of samples. The temporals are scale-like and on 73.3 per cent of the sides consist of two scales followed by three (2 + 3), but 2-2 are present on 17.9 per cent of the sides, and 3 + 3, 4 + 3, 3 + 4, and 3 + 2 sometimes occur.

Dentition: Counts for 78 maxillae have been tabulated, but the number of teeth in other bones has been determined on both sides of only three specimens. On all specimens examined the anterior maxillary teeth are subequal and vary in number from 10 to 12, invariably followed by a diastema and three enlarged teeth. The formula is 11 + 3 on 78.5 per cent of the sample, 12 + 3 on 15.4 per cent, and 10 + 3 on 5.1 per cent. Means and extremes (in parentheses) for the teeth in other bones are as follows: palatine 6.6 (6–8), pterygoid 11.8 (9–13), dentary 16.1 (15–18).

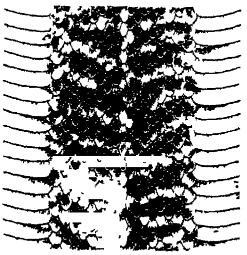

FIG. 9

Fig. 9. Midbody pattern of *S. h. mojavensis* (B.Y.U. No. 1499, from St. George, Washington County, Utah). This aberrant pattern is characteristic of specimens from Utah and Coconino County, Arizona; it also occurs on one specimen from Mount Grant in Mineral County, Nevada.

Dimensions: The largest specimen examined is a male taken "20 miles from Mojave," Kern County, California, measuring 941 mm. over all. The largest female, from the same county, 20 miles south of Inyokern, is 802 mm. in total length, with a portion of the tail missing. Ratios of tail to total length vary from 0.21 to 0.24 in males and females, with a mean of 0.23 for both sexes.

Pattern: On the majority of specimens the pattern approximates that described for the type. However, around the periphery of the range, except in southeastern San Bernardino County, California, where intergradation with *hexalepis* occurs, some specimens are marked with darker cross bars. In the southwestern portion of the range (see fig. 10) these dark cross bars are not clearly defined and they do not obscure the vertebral stripe. A more strongly barred pattern is characteristic of specimens from Utah, and from the Grand Canyon and the Painted Desert in Coconino County, Arizona. On these the vertebral stripe is irregular and broken by the dark bars which may also extend onto the lower scale rows and even onto the ventrals (fig. 9). In Nevada a similar pattern is found on one specimen from Mount Grant, Mineral County, and traces of cross bars are present on specimens from Clark County. On a very few individuals the secondary stripe on the third and fourth rows may be scarcely evident on the third row so that the pattern may resemble that found on *S. h. deserticola.*

Sexual Dimorphism: Whereas the means for ventral counts and tail length ratios are virtually identical, there are evidently differences between the sexes in subcaudal counts and in the position of the lateral scale row drop at midbody, as noted above. As in other races of *hexalepis*, strongly keeled scales are present above the anal region on sexually mature males, whereas the scales in the same region are smooth in females or very faintly keeled on larger specimens. Males probably exceed the females in size, since nearly one-third of 31 males measured exceed in total length the largest female in the sample.

Geographical Variation: As noted above, the specimens with barred rather than simple lineate patterns occur around the periphery of the range, except on the southeast. Likewise specimens with the sixth, or with the fifth and sixth, supralabials reaching the eye tend to occur most frequently in peripheral local populations. Utah specimens represent an aberrant population, with five out of seven specimens being asymmetrical in the character. On seven specimens from Washington County, Utah, the sixth labial reaches the eye on nine sides, and the fifth and sixth reach the eye on two sides. Only three sides conform to the condition characteristic of the majority of the specimens referred to *mojavensis*. A single labial reaches the eye also in the majority of specimens taken along the southern edge of the range. But all specimens from the Grand Canyon and the Painted Desert in northern Arizona conform in having the labials separated from the eye.

In but one other character is there much evidence of geographical variation; the mean ventral counts tend to be highest in San Bernardino and Inyo counties, with the lowest individual counts occurring at the extreme north end of the range, in Nevada and in Utah. Two females each with but 191 ventrals, the minimum count for the subspecies, are from Sutcliffe, Nevada, and from Zion National Park in Utah. Insufficient material is available, however, to work out gradients with satisfactory results, there being too few specimens from any single county.

INTERGRADATION: Where the range of *mojavensis* abuts that of *virgultea* in northern Los Angeles County, California, relatively few specimens have been taken. However, one specimen, U.M.M.Z. No. 84910 from Lake Hughes (a small sag pond on the San Andreas Fault and separated from the Mojave Desert by a low ridge), is intermediate in pattern characters, although in scutellation it more closely approximates *virgultea*. The light vertebral stripe is three scales wide at midbody and broadens to seven scales in width on the occiput where it merges with the slightly darker coloration of the cephalic plates. A well-defined, dark, lateral stripe extends onto the temporal region, and at midbody it includes scale rows three to seven, with the split in the stripe becoming apparent as a result of light margins on the upper portion of scales in the fourth row and the lower margins of those in the fifth row. The snake is 1075 mm. over all (tip of tail missing) and thus exceeds in length any specimen of *mojavensis*. In pattern characters this Lake Hughes individual resembles snakes of the species from southern Baja California.

The few other snakes taken along the southwestern border of the Mojave Desert in the region centering around Antelope Valley tend to be darker than *mojavensis* from the center of the range. It may be noted that while these specimens are sufficiently light in coloration to be referred to *mojavensis*, most of them lack the complete row of suboculars that occlude the sixth supralabial from the orbit.

Intergradation with *S. h. hexalepis* takes place over a wider area, and the pattern changes involved in the transition of one race with the other are so subtle that it is impossible to select any individual specimens which might be designated as intergrades. A specimen from the Chemehuevis Mountains in Arizona has a pattern more or less intermediate between that of *hexalepis* and that of *mojavensis*, and the sixth labial reaches the eye on one side but a complete row of suboculars is present on the other. This specimen has somewhat arbitrarily been referred to *mojavensis*. On a similar basis three specimens from the Providence Mountains, which lie somewhat farther north on the California side of the Colorado River, are referred to *hexalepis;* these specimens uniformly have the sixth supralabial reaching the eye, but their patterns are essentially those of *mojavensis*. Thus, southeastern San Bernardino County, California, represents a region where the diagnostic characters are shuffled, so to speak, and to some extent the mixture of scale characters evident in this zone extends along the Colorado River to its junction with the Virgin River in Nevada and continues into southwestern Utah. In contrast the Coconino County population in Grand Canyon and the Painted Desert is uniform in lacking the suboculars, but is atypical in having the barred pattern.

In the southwestern corner of the range, *mojavensis* ranges as far south as Twentynine Palms, and a specimen (no longer extant) from Quail Springs near the summit of the Little San Bernardino Mountains was quite typical in pattern and scalation. The escarpment on the south is steep, however, and all patch-nosed snakes taken in Coachella Valley in Riverside County are referable to *S. h. hexalepis*.

RANGE: Principally the Mojave Desert,

from Washoe County, Nevada, on the north, southeastward across southern Nevada to Washington County, Utah, and through the Grand Canyon to portions of the Painted Desert in Coconino County, Arizona. On the south *mojavensis* merges with S. *h. hexalepis* in Mojave County, Arizona, and in southeastern San Bernardino County, California. In the southwestern portion of the range in California intergradation with *S. h. virgultea* occurs in northern Los Angeles County, and possibly in central Kern County where the range extends through Tejon Pass into southern San Joaquin Valley.

The following specimens comprise the paratypic series:

UTAH

Washington County: Zion National Park (Z.N.P. no number, B.Y.U. No. 2880); St. George (B.Y.U. Nos. 1499, 1097); Santa Clara (R.H. 2 specimens, no number); and "Cottonwood Canyon" presumptively in the county (U.S.N.M. No. 9101).

ARIZONA

Coconino County: Tanner's Spring near Tuba City (M.V.Z. No. 2681); 9 miles west of Cameron (L.M.K. No. 34439); 15 miles north of Cameron (M.V.Z. No. 19206); Tonto Platform, Bright Angel Trail, Grand Canyon (G.C.N.P. Nos. R-29, 76). Mojave County: Mojave Valley (U.S.N.M. No. 4770); Fort Mojave (M.V.Z. No. 8286); White Hills, 28 miles north of Chloride (L.M.K. No. 25385); Lucky Star Mine, Chemehuevis Mountains (S.D.S.N.H. No. 17315).

NEVADA

Washoe County: Sutcliffe near Pyramid Lake (C.A.S. No. 40506). Churchill County: 7.5 miles east of Frenchman's Flat (M.V.Z. No. 16179). Lyon County: Near Nordyke (S.U.M. No. 8177). Mineral County: 10 miles east of Basalt (U.M.M.Z. No. 84909); 7.5 miles northwest of Hawthorne (M.V.Z. No. 20396); Cottonwood Creek, Mount Grant at an elevation "below 7400 feet" (M.V.Z. No. 17130). Nye County: Near Skeleton Hills (S.U.M. No. 10324); near Bullfrog, Armagosa Desert (S.U.M. No. 10325); Tonopah (M.V.Z. No. 17598). Clark County: 20 miles north of Boulder Dam (M.V.Z. No. 19263); Virgin River (U.S.N.M. No. 18062); Las Vegas (A.M.N.H. No. 9681); 19 miles southeast of Indian Springs near Corn Creek (L.M.K. No. 25386); 2 miles east of Indian Springs (M.V.Z. No. 33722); 13 miles west of Indian Springs (L.M.K. No. 25357).

CALIFORNIA

Inyo County: Daylight Pass, Funeral Mountains (L.M.K. No. 32827); Johnson Canyon (M.V.Z. No. 6689); 3 miles southwest of Wildrose Station (L.M.K. No. 34100), and Towne's Pass (L.M.K. No. 25384), all in the Panamint Mountains; Maturango Spring (U.S.N.M. No. 18060), Mountain Spring (C.A.S. No. 65499, M.V.Z. Nos. 33720, 33721), Shepherd Canyon (U.S.N.M. No. 18059), and Homeward Canyon (C.A.S. No. 65498) in the Argus Mountains; Linnie (L.M.K. No. 28578); Amargosa Borax Works (U.S.N.M. No. 18061). San Bernardino County: Near Cave Spring, Avawatz Mountains (S.U.M. No. 10354); Mountain Pass (L.M.K. Nos. 33446, 4400) and Wheaton Springs (L.M.K. No. 4401) in the Ivanpah Mountains; Klinefelter (L.M.K. No. 10692); 7 miles west of Red Pass, northeast of Barstow (L.M.K. No. 35896); Hawes (L.M.K. No. 33951); Phelan (U.C.L.A. No. 17); Twentynine Palms (L.M.K. No. 8503). Kern County: Dove Springs, Red Rock Canyon (U.C.L.A. No. 87); 20 miles south of Inyokern (L.M.K. No. 26130); 3 miles west of Rosamond (U.C.-L.A. No. 461); "20 miles from Mojave" (C.U. No. 3625); mouth of Kern Canyon (H.T.W. no number); 2 miles north of Grapevine Station (L.M.K. No. 25864), Kern River, near Bakersfield (G.W.H. no number). Los Angeles County: Wilsona (U.C.L.A. No. 57); Harold (U.C.L.A. No. 58).

DISCUSSION

On the basis of pattern and scale characters it is possible to segregate five races of *Salvadora hexalepis*. Pattern characters are most variable in *hexalepis* and *mojavensis*, and least variable in *deserticola*. Similarly the diagnostic scale characters are least variable in *deserticola*, and most variable in *hexalepis* and *mojavensis*. To some extent the greater variation in scale characters may be attributed to the fact that the primary segregation of specimens in the samples was made upon the basis of pattern characters, whereas differentiation in scale characters rarely occurs in precisely the same zone as intergradation in pattern characters. In southeastern Arizona the difference in pattern between *hexalepis* and *deserticola* is virtually a dichotomous one, and it is closely correlated with loreal characters. However, the number of labials reaching the eye, usually two in *deserticola* and one in *hexalepis*, is also of diagnostic value. But along the eastern periphery of the range of *hexalepis*, particularly in Pima and Pinal counties, two labials reaching the eye is not a rare character in specimens having the pattern of *hexalepis*. In fact it is found on 50 per cent of the specimens from the two counties. Similarly a high percentage of the specimens in the *mojavensis* sample having one labial instead of no labials reaching the eye are from the southern portion of the range. In addition, the two local populations, inhabiting (1) the valleys of the Virgin River and its tributaries and (2) the Grand Canyon appear to represent aberrant offshoots in pattern characters, the more northern one retaining scale characters of *hexalepis* whereas the strain in Grand Canyon has the scale characters of *mojavensis*.

In view of these facts it is instructive to note that the statistical validity of diagnostic characters is dependent upon the sources of material composing the sample. Had the bulk of the specimens comprising the *hexalepis* sample been taken in Pima or Pinal counties the supralabial-eye character would have appeared to be of little value. Or had most of the specimens assigned to *mojavensis* been taken in northern Los Angeles County, only pattern characters would have served to differentiate the race.

Valid use of statistical methods presupposes random sampling, and certainly the material available to taxonomic workers is ordinarily not consciously "selected." On the other hand larger series of specimens tend to be assembled in more densely populated areas, and to this extent our samples are often biased. For examples, the majority of the specimens of *klauberi* were secured in the south end of the peninsula, the bulk of the available *virgultea* are from San Diego County, California, and more specimens of *hexalepis* are from Pima County, Arizona, particularly from the vicinity of Tucson, than from any other county within the range of the species. More than one-third of the specimens assigned to *deserticola* come from southeastern Arizona. All samples available in this study, with the possible exception of that from the Mojave Desert, are biased, therefore, to the extent that one portion of the range is better represented than are other portions.

It follows that a simple tabulation of characters for the whole sample does not provide an adequate summary; the true picture is not represented. On the other hand the small number of specimens available from most counties within the range of the species *hexalepis* precludes adequate treatment of the data if specimens from restricted areas are segregated for consideration. Hence there is no completely satisfactory alternative at present, but the table below must be interpreted in the light of the previous discussion.

The number of supralabials in contact with the eye, or, more precisely, in contact with the ocular scale covering this organ, varies more or less independently of most other scale characters. In part the nature of the contact is correlated with the number of suboculars, but the correlation is not so perfect as one might expect. The number of supralabials anterior to the eye, of course, determines which of these reach the eye, but not how many. Two supralabials beneath the eye may be coalesced into one, but this abnormality is so rare as to be of little importance. As may be observed in table 1, the number of supralabials reaching the ocular is of diagnostic importance, particularly when it is borne in mind that the primary segregation of specimens comprising the sample was based upon pattern characters. Despite the fact that changes in supralabial characters lag behind the pattern changes in the zones of intergradation between some races, the majority of specimens from each of three regions conform to one of three conditions encountered in the supralabial-ocular character.

By means of this character it is possible to segregate two pairs of populations, and a third single population. A directional trend from south to north is apparent, with a single northern population most poorly differentiated. In essence the variation is clinal, but the change occurs in steps rather than being continuous. On a statistical basis a "step cline" is indicated, with lateral populations differentiated on pattern characters at the south end of the cline.

In the tabulation which follows the subspecies are arranged in the order of their geographic occurrence from north to south in the vertical column, with the forms on the western edge of the range preceding those on the east.

TABLE 1

SUPRALABIALS IN CONTACT WITH THE OCULAR
(Percentage of the sample in each class)

Subspecies	Number of Sides Tabulated	0	1	2	3
S. h. mojavensis	124	71.0	26.6	2 4	0
S. h. virgultea	236	5.1	84.3	10.6	0
S. h. hexalepis	192	4.2	72.4	23.4	0
S. h. klauberi	76	0	18.4	81.6	0
S. h. deserticola	148	1.4	2.7	94.5	1.4

On the basis of these data, as well as other evidence that need not be discussed here, it may be hypothesized that *deserticola* represents the most primitive population. *S. h. mojavensis* at the north end of the cline is the most poorly differentiated, and probably the most recently evolved.

SUMMARY

Five subspecies of *Salvadora hexalepis*, two of them described herein, are recognized. The known ranges of the races are mapped, and it is shown that one scale character of diagnostic importance varies from south to north as a "step cline" when populations are segregated primarily on pattern characters. A key to the races is supplied.

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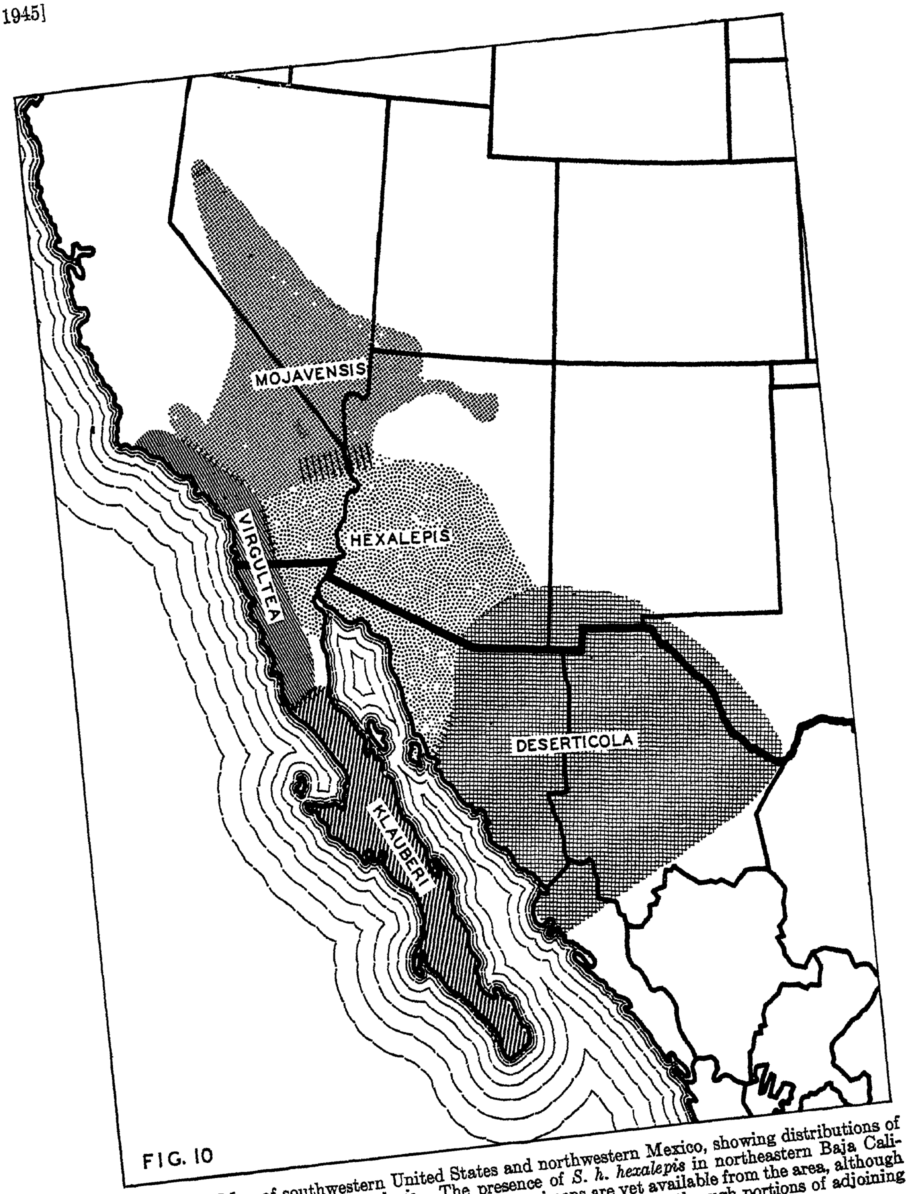

FIG. 10

Fig. 10. Map of southwestern United States and northwestern Mexico, showing distributions of the subspecies of *Salvadora hexalepis*. The presence of *S. h. hexalepis* in northeastern Baja California, indicated on the map, is hypothetical; no specimens are yet available from the area, although it is relatively certain that *S. h. hexalepis* occurs there. Parallel lines through portions of adjoining ranges indicate known regions of intergradation.

KEY TO THE SUBSPECIES OF *Salvadora hexalepis*

A. Two supralabials (usually the fifth and sixth) reaching the eye.
  B. Loreal single; lower lateral stripe on fourth scale row; subcaudals on males 76 to 87, on females 66 to 82; ventral scales usually less than 192 (82 per cent)............................*deserticola* Schmidt
  BB. Loreal divided; lower lateral stripe on third and fourth scale rows; subcaudals on males 91 to 103, on females 86 to 100, ventral scales usually more than 192 (94 per cent)...................*klauberi* Bogert
AA. One supralabial (usually the sixth) reaching the eye.
  B. Light vertebral stripe three scales in width; top of head gray; lateral stripe distinctly separated at midbody.........*hexalepis* (Cope)
  BB. Light vertebral stripe one and two half scales in width, top of head brown, lateral stripe not or feebly separated at midbody........*virgultea* Bogert
AAA. No supralabials reaching the eye (owing to the presence of suboculars).
  B. Lower lateral stripe on third and fourth scale rows fainter than the upper stripe on the sixth and seventh rows; the entire pattern is sometimes obsolescent or, in the eastern portion of the range, cross bars obscure the vertebral stripe...............................*mojavensis* Bogert

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A RECENTLY ACQUIRED ALBIAN AMMONITE FROM ANGOLA

BY OTTO HAAS

Although the Vernay collection of Albian ammonites from Angola includes 124 forms (Haas, 1942b, p. 206), one of the most spectacular species previously published, *Elobiceras neuparthi* (Choffat), is not represented. However, in 1944, the American Museum of Natural History was especially fortunate in receiving from Mr. H. B. Nannestad, Chief Engineer, "S.S. Talisman," through the courtesy of Dr. James P. Chapin, the specimen from Lobito Bay depicted in figures 1 to 3.

This topotype, reaching a diameter of 270 mm., is considerably larger than Choffat's holotype (1905, p. 38, pl. 2, fig. 1a, b, pl. 3, fig. 1c) which measures only 220 mm., and is almost as complete and well preserved as the latter. It may, therefore, deserve publication.

The height of its outer whorl is 26 per cent of the diameter; its height, measured in the median plane, 25 per cent; its intercostal width, 19 per cent; and its costal width, 26 per cent. The width of the umbilicus is $51^1/_2$ per cent of the diameter. The ratio of intercostal width is the same as that found in the holotype.[1] That the umbilicus is wider ($51^1/_2$ as compared to $45^1/_2$ per cent[1]) and the outer whorl accordingly lower (26 as compared to 30 per cent[1]) than in the holotype is due to the fact that the egression of the spiral, also observable in Choffat's plate 2, plays an even more important part in the topotype which attains a greater size.

The difference most noticeable at first sight is the greater density of the costation in the holotype, whose last whorl carries altogether 44 ribs, as compared to only 28 in the topotype. However, if the ribs are counted back from the same diameter of 107 mm. in both shells, the results (21 per half whorl in the holotype, 24 in the topotype) deviate much less from each other. This difference hardly exceeds the limits of individual variation. Also, the considerable difference in the total of ribs of the outer whorls is obviously due to the greater size attained by the topotype, the rapid decrease in density of costation on the body chamber having already been emphasized in Choffat's original description of this species.

Thus both the differences discussed above can be derived from ontogenetic circumstances, and they therefore can hardly cast any doubt on the full conspecificity of the specimen here described with Choffat's holotype. The writer's belief in this conspecificity is based chiefly on the full agreement of both shells in the character of ornamentation. The ribs are almost straight at first, then (between the diameters of about 100 and 160 mm.) become decidedly sigmoidal and more prorsiradiate than before, and, later, again less sigmoidal and less prorsiradiate. In both specimens they lose the spiral ridges characteristic of the genus *Elobiceras*, to which this species is referred by the writer (see Haas, 1942b, pp. 100, 121), on the body chamber, viz., at diameters of about 150 and 200 mm., respectively. However, where the test is preserved, a faint spiral striation remains visible, even in the intercostals, up to diameters of 195 mm. in the holotype and of 215 mm. in the topotype. From a diameter of about 110 mm. the ribs carry pronounced, knob-like external tubercles[2]

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[1] For the sake of better comparison, these figures are based on my own measurements of Choffat's photographs of the holotype, taken by the methods regularly applied in my studies, not on Choffat's (*ibid.*, p. 38) measurements.

[2] After the study of the specimen here dealt with I can no longer maintain my previous opinion (1942b, p. 121) that the external knobs are less prominent in *E. neuparthi* than in *E. browni* Haas (1942b, p. 120, pl. 21, figs. 2, 3, pl. 22, fig. 1a–c, text fig. 12e). However, the other differences pointed out there suffice to distinguish these species.

Fig. 1. *Elobiceras neuparthi* (Choffat), topotype, A.M.N.H. No. 26045, from the Albian of Lobito Bay, Angola. Right side view, × 1/2

Fig. 2. *Elobiceras neuparthi* (Choffat), topotype, A.M.N.H. No. 26045, from the Albian of Lobito Bay, Angola. Ventral view, × 1/2.

which fade only at a short distance from the apertural margin where the costation, too, degenerates rather suddenly, the ribs losing in prominence, becoming fold-like and, once more, strongly prorsiradiate. In addition to the external nodes, there are radially elongated lateral ones which culminate somewhat above the middle of the flanks. They begin to be indicated at diameters between 100 and 125 mm. and reach their maximum development at diameters of about 200 mm. in the holotype and of about 225 mm. in the topotype, about a sixth and a quarter, respectively, of a whorl apicad of the anterior end. It is true that they are less developed in the holotype than in the individual here described, but they are far from being absent in the former, although no mention of them is found in Choffat's original description. They can readily be recognized in his side view (1905, pl. 2, fig. 1a) and are indicated in his sectional diagram (*ibid.*, fig. 1b) also, but at the place of this cross section they appear to be in a higher position than elsewhere in the outer whorl.

Fig. 3. *Elobiceras neuparthi* (Choffat), topotype, A.M.N.H. No. 26045, from the Albian of Lobito Bay, Angola. Upper half of frontal view, × 1/2, to show fastigation of outer whorl near aperture.

Whereas Choffat states the body chamber to occupy three-quarters of it in the holotype, only a little more than half a volution is unseptate in our topotype. Nevertheless the apertural margin cannot have been far distant from the actual anterior end, as may be seen not only from the degeneration of the sculpture, described above, but also from the simultaneous, rather sudden fastigation of the periphery (see fig. 3), which is rather truncate up to this point.[1] The same phenomenon has been repeatedly recorded in this genus (see, e.g., Haas, 1942b, pl. 32, fig. 1b, c, and pl. 29, fig. 1d) as well as in others (see, e.g., *Sharpeiceras goliath* Haas, 1942a, fig. 7b, c) and, in a more general scope, discussed (Haas, 1942b, p. 213) by the writer.

In his original description Choffat mentions merely that the suture lines are only imperfectly visible in the holotype. The present specimen, however, permits their study at various diameters between 65 and about 200 mm., though nowhere completely enough to warrant delineation. From what can be seen it may well be inferred that the sutural characters also support the reference of this species to the genus *Elobiceras*. About the same features prevail as in some other forms of this genus at the corresponding diameters, e.g., *E. irregulare* (Spath), var. *rigidecostata* Haas (Haas, 1942b, pl. 35, fig. 2), *E. raymondi*, Haas (*ibid.*, pl. 35, fig. 10b), *E. intermedium* Spath (*ibid.*, text fig. 13b, α and β). The degree of indentation is comparatively high. The main lobes are comparatively wide, especially so in their lower portions, and the main saddles appear to be rather deeply intersected by lobules and considerably straitened in their lower parts by the far expanding branches of the lobes; this seems to be particularly true of the first lateral saddle. The first lateral lobe seems to be, though somewhat asymmetrically, bifid, the second trifid.

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[1] To judge by Choffat's side view (pl. 2, fig. 1a), a similar change seems to take place in the holotype also.

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RESULTS OF THE ARCHBOLD EXPEDITIONS. NO. 54

THE MARSUPIAL GENUS *PSEUDOCHEIRUS* AND ITS SUBGENERA

BY G. H. H. TATE

The second and third Archbold Expeditions to New Guinea, undertaken in 1936 and 1938, have added substantial numbers of specimens to the collection of *Pseudocheirus* already contained in the American Museum of Natural History. Furthermore, a number of specimens from northern Queensland, collected by Miss Gabriele Neuhäuser, and the important series obtained by the late Henry C. Raven in Queensland, New South Wales, and Tasmania, both lots previously unstudied, have furnished valuable data. Loans of material by Dr. Remington Kellogg, the United States National Museum, and Miss Barbara Lawrence, the Museum of Comparative Zoölogy, to both of whom I wish to express my deep thanks, have further swelled the source material upon which this paper is based. I am particularly indebted to the authorities in the European and Australian museums, visited in 1937, for granting me facilities to study and photograph many of the type specimens and others in their charge.

Measurements, particularly of the teeth, of nearly all the types and as far as possible of substantial series of topotypes and others are shown at the end of this paper. One new race, *P. herbertensis cinereus*, is described.

The word *Pseudocheirus* [*sic*] was twice used by Ogilby (September, 1837a; 1837b). It was proposed in proper form for a new subgenus of *Phalangista*. Later citations by Waterhouse (1846) and Thomas (1888), using the spelling *Pseudochirus*, relate to a *nomen nudum* (Ogilby, 1836). Other authors, including even Palmer (1904), continued to employ that form of spelling, which under the Rules of the International Commission on Zoological Nomenclature[1] is not permissible.

In the present paper, *Pseudocheirus* is held to comprise the following subgenera: *Pseudocheirus* (including *Pseudochirulus*), *Pseudochirops*, *Petropseudes*, and *Hemibelideus*. These subgenera have very unequal values and relationships. *Petropseudes* is considered to be a derivative of *Pseudochirops*. *Hemibelideus* may be a much older relict from the same line. *Pseudochirops* and *Pseudocheirus*, though distinct, share common ancestry. Two other full genera are related to the foregoing assemblage, *Schoinobates*, the pseudocheiroid flying phalanger, and *Phascolarctos*, the koala. The whole, in which possibly fossil genera should be included (I have not examined the fossil forms), constitutes a selenodont subfamily of the family Phalangeridae.

KEY TO THE SUBGENERA OF *Pseudocheirus*

1. Palate unbroadened; crown of i^2 little or not at all lengthened in proportion to that of i^3. . *Pseudocheirus*

   Palate markedly broadened; crown of i^2 about half as long again as that of i^3. 2
2. Tail with erect hairs almost to the tip; skull with inferior wall of audital meatus inflated and cellular. . . . .*Hemibelideus*

   Tail with hairs of terminal fourth appressed; inferior wall of meatus solid. 3

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[1] Article 19 (Original orthography); Article 35, Section a (ei and i synonymous; older spelling to take precedence).

3.	Tail very much shorter than head and body; mastoid swellings exaggerated upward.... ...*Petropseudes*	Tail almost as long as head and body; mastoids more or less inflated, but not upward...........*Pseudochirops*

GEOGRAPHICAL DISTRIBUTION

The accompanying chart (fig. 1) shows a preponderance of species of *Pseudocheirus* in New Guinea and northern Australia and, in contrast, few species through the rest of forested Australia (with Tasmania). In no one part of high mountainous New Guinea are fewer than three species found. This number rises to five, perhaps six, in the Central Range of Netherlands New Guinea.

The southeastern part of the Central Range lacks the three western species, *caroli*, *pygmaeus*, and *albertisii;* but on the other hand, two of the species of eastern New Guinea, *corinnae* and *cupreus*, although present in the Mount Wilhelmina area, remain unrecorded from the western end of the Central Range and from Vogelkop. One of these, *corinnae*, is allied to the north Queensland species *archeri*.

A unique distributional pattern, still poorly substantiated, is seen in *albertisii*, which has thus far been taken in the Arfak and Weyland Mountains, near Sorong (extreme northwestern Vogelkop), on Japen Island in Geelvink Bay, at the Cyclops Mountains on the north coast, and near the Sepik River, probably in the mountains west of it. This pattern indicates for *albertisii* a western and northern distribution.

Four northern Queensland species are absent from Papua, but two of them, *peregrinus* and *archeri*, show much closer relationship to Papuan species than do the others, *herbertensis* and *lemuroides;* the last-mentioned is so strongly divergent as to be considered a monotypic subgenus (*Hemibelideus*). Both *herbertensis* and

Full Species	Vogelkop	Weyland Mts.	Wilhelmina Mts.	Cyclops Mts.	Huon Peninsula	East New Guinea	North Territory: Australia	Eastern Australia				Tasmania	S. Australia	S. Western Australia
								N. Queensland	S. Queensland	N. S. Wales	Victoria			
Pseudocheirus														
peregrinus								—	—	—	—			
caroli		—												
forbesi	—	—	—	—	—	—								
pygmaeus		—	—											
canescens	—	—	—	—	—	—								
occidentalis														—
rubidus									—					
victoriae											—		—	
convolutor												—		
herbertensis								—						
Pseudochirops														
archeri								—						
corinnae			—		—	—								
cupreus			—			—								
albertisii	—	—	?	—										
Petropseudes							—							
Hemibelideus								—						
Totals	3	5	5½	3	3	4	1	4	2	1	2	1	1	1

Fig. 1. Distribution of the species of the genus *Pseudocheirus*.

archeri show nearly identical restricted geographical ranges in northern Queensland, but *peregrinus*, if I am right in holding it to be conspecific with *laniginosus*, occupies almost the whole of eastern Australia.

The remaining Australian species, isolated in varying degrees both morphologically and geographically, comprise *rubidus* of southern Queensland, *victoriae* of southeastern Australia, *convolutor* of Tasmania and Flinders Island, *occidentalis* of extreme southwestern Australia, the subgenerically monotypic *dahli* of the Northern Territory, and *lemuroides* of northern Queensland.

One is struck by the tendency in virtually all species of *Pseudocheirus* to inhabit hilly country well above sea level and to be absent from coastal lowlands. This fact may account for the rarity of *Pseudocheirus* on islands,[1] in contrast to species of the ecologically and functionally similar genus, *Phalanger*. The animals are less likely to be carried out to sea on natural rafts or to fall into the hands of coast-dwelling natives who may take them to islands in canoes.

The altitudinal ranges of most of the species in New Guinea include several thousands of feet. The species that dwells at the highest levels is the tiny *P. pygmaeus*, specimens of which have been collected as high as 12,000 feet. Conversely the lowest record for any of the species inhabiting the lower levels in New Guinea is 600 feet above sea level. In Australia, particularly in temperate Australia and Tasmania, this condition may not hold. The number of species of *Pseudocheirus* occurring in successive 1000-foot altitudinal bands has been plotted (fig. 2). In studying that figure it must be remembered that some of these species, especially those of Australia, may be limited in their upward spread by absence of higher mountains carrying forested environment suited to their requirements. There seems to exist a critical level at about 7000 to 8000 feet, above which most of the species, even of New Guinea, do not occur. The high-altitude species, *pygmaeus*, found up to

Full Species	Thousands of feet above sea level													Region of New Guinea or Australia
	1	2	3	4	5	6	7	8	9	10	11	12		
Pseudocheirus														
peregrinus		—	—	—	—	—								Eastern Australia
caroli	—	?	?	?	—	—	—							Central Netherlands New Guinea
forbesi		—	—	—	—	—	—							New Guinea
pygmaeus							—	—	—	—	—	—	—	Netherlands New Guinea (high mountains)
canescens	—	—	—											New Guinea (foothills)
occidentalis	?	—	—											Western Australia (south)
rubidus			—	—										Southern Queensland
victoriae	—	—	—	—	—									Victoria and south Australia
convolutor	—	—												Tasmania and Flinders Island
herbertensis		—	—											Northern Queensland
Pseudochirops														
archeri		—	—											Northern Queensland
corinnae	—	—	—	—	—	—	—	—						Central and eastern New Guinea
cupreus						—	—	—						Central and eastern New Guinea
albertisii			—	—	—									Northwestern and northern New Guinea
Petropseudes	—	—												Northern Territory, Australia
Hemibelideus		—	—											Northern Queensland
Totals	6½	12½	11½	6	7	6	5	3	1	1	1	1		

Fig. 2. Species density of the genus *Pseudocheirus*.

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[1] *P. canescens* on Salawatti; *P. albertisii* on Japen.

12,000 feet, diverges from all others by attaining its downward limit at about 6000 feet. (It is a member of a small, quite specialized, high-mountain fauna, which includes peculiar mountain-living species of *Peroryctes*, *Dorcopsis*, and several rodents.) The species of *Pseudocheirus* occurring next highest in New Guinea is *cupreus*, with altitudinal range between 5000 and 8000 feet.

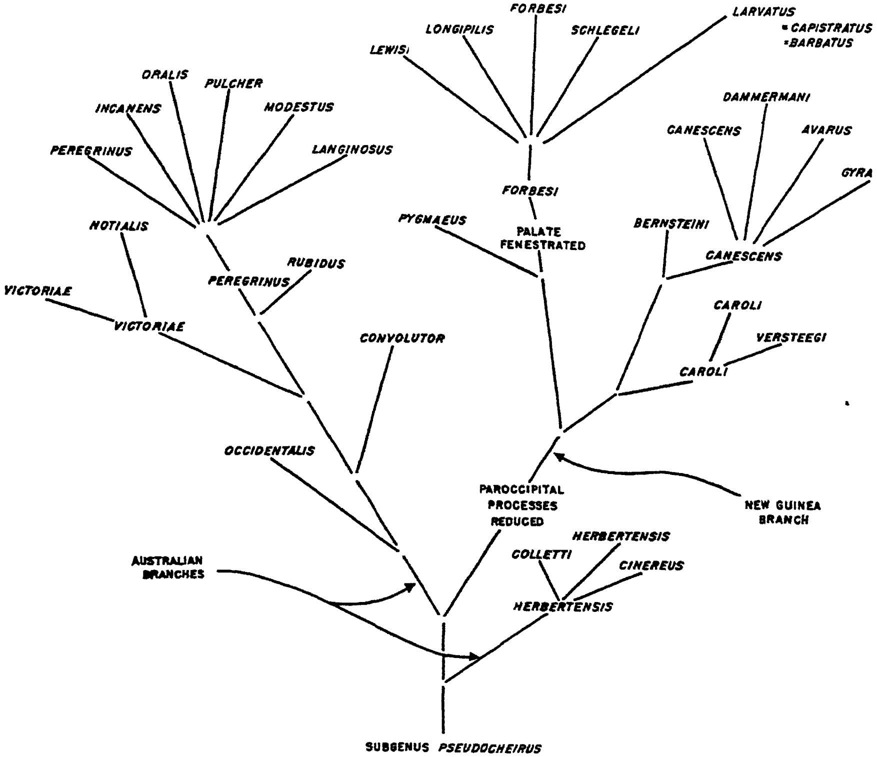

Fig. 3. Phylogenetic tree of the subgenus *Pseudocheirus*.

In the Torres area, between the southern spurs of the Leonard Murray Range and the northern ridges of the hills at the base of Cape York Peninsula, the total lack of hills, other than a very few scattered granite knobs a few hundred feet high, presents today an impassable barrier to migration of *Pseudocheirus*. This would be true even if the Torres Strait were dry land. Even so, communication must have existed from time to time in this area in the not very distant past.

The restriction of *Pseudochirops* to New Guinea and adjoining parts of Australia (*archeri* in northern Queensland, *dahli* in Northern Territory), presents a decided contrast to that of the widely dispersed subgenus *Pseudocheirus*. In the case of *Pseudochirops* one can hardly escape the conclusion that New Guinea, with Torresia, served as the region in which the species evolved and gradually dispersed. The fairly close relationship of the mid-mountain *cupreus* of the south side of the central Papuan mountain system to *dahli*, inhabitant of rocky scrub near Darwin, calls for such a region of origin. A similar case is seen in the relationships of *corinnae* of mid-mountain New Guinea and *archeri* of northern Queensland.

In the subgenus *Pseudocheirus*, the relationships are less obvious. Of the ten specific groups recognized in this paper, four are Papuan and six Australian (including Tasmania). Relatively great uniformity of structure prevails throughout. Specializations of various sorts can be noted in *canescens* and *forbesi* of New Guinea and in *herbertensis*, *convolutor*, and *occidentalis* of Australia. This specialization expresses a degree of difference from typical *peregrinus* which is only a little greater than is shown by a number of other more closely allied species (fig. 3). At best, the differences are slight. Outstanding primitiveness appears in no part of the group. One gathers an impression of an extremely stable, very widely dispersed type of organism that at various periods during development has produced local variations of minor importance here and there throughout its range. The fact that one of its members extends upward to 12,000 feet suggests the completeness of environmental penetration as well as the antiquity of the subgenus.

SKULL STRUCTURE

Throughout the history of marsupial taxonomy, the presence or absence or relative size and proportions of those openings in the roof of the palate which lie between the palatal and maxillary bones have been cited by authors when distinguishing one species of a genus from another. Development of the openings in question appears to vary throughout marsupials of all taxonomic categories above the rank of subgenus. This fact shows up in genus after genus; the sizes of the said foramina are employed to help in distinguishing species or merely races from one another. Even in the American opossums of the genus *Marmosa* (all species possessing posterior palatal openings), the degree of such fenestral development has been utilized in classification (Tate, 1933). This character, though it must be used with care and judgment, is valuable in working with many Australian genera, including *Phalanger*, and particularly in the present genus *Pseudocheirus*. In this genus its taxonomic utility seems not to go higher than the species, and differences in the size of the openings seem most applicable to the distinction of geographical races.

Enlargement of the mastoid to form resonance chambers is a phenomenon repeated frequently in many of the marsupials and placentals. In *Pseudocheirus* it is the rule rather than the exception. Minimum development of this character is to be seen in *peregrinus*, *pygmaeus*, *convolutor*, etc.; in the subgenus *Pseudochirops* minimum enlargement occurs in *corinnae* and *archeri*. The usual course of development of such mastoid swelling is lateral and ventral, so that the total mastoid width equals or exceeds the total width across the meatal tubes, and confluence of the mastoid and alisphenoid enlargements beneath the skull is attained. In extreme cases posterior expansion is added, as in *P.* (*Pseudochirops*) *cupreus*, so that the mastoid chambers exceed the condyles backwards. Finally, dorsal expansion is seen also to have taken place in the case of *Petropseudes*, which appears relatively exaggerated by the otherwise flattened form of the skull. In *Hemibelideus* an extension of this cellular bony structure into the inferior wall of the meatal tube has occurred.

The paroccipital processes are typically (in the type species) somewhat slender, slightly buttressed toward the inner side of the bullae, and show smooth transition to the mastoid enlargements on their outer faces. Their length, taken from the level of the lower surface of the mastoids to the slightly knobbed tips, is about one-half of their distance apart. This general condition appears also in all the east Australian races of *peregrinus*. In other species modifications are found.

Shortening and thickening of the processes have developed in the two extreme southern species, *convolutor* of Tasmania and *occidentalis* of southwestern Australia; this is more pronounced in the latter, in which the length of the process below the mastoid is only 6 mm. in proportion to the outer width across the paroccipitals, 22 mm., or 28 per cent. In the otherwise aberrant *P. herbertensis* the state of the paroccipitals is about as in *convolutor.*

In *forbesi* and *avarus* such reduction has advanced to 2:17.5, or 11 per cent; *caroli*, to 3:18, or 17 per cent; in *pygmaeus* to 1.7:10.5, or 16 per cent. Suppression of these structures is found only in species from New Guinea.

Turning to the subgenus *Pseudochirops*, we find the following proportions for these processes: *archeri*, 5.3:16.5, or 32 per cent; *corinnae*, 6.8:18.8, or 31 per cent; *cupreus*, 5.6:22, or 25 per cent; *albertisii*, 6:18, or 33 per cent. The apparent shortening in *cupreus* is probably due to enlargement of the mastoid swellings ventrally. No suggestion of extreme reduction such as appears in *forbesi*, *avarus*, and *pygmaeus* of the subgenus *Pseudocheirus* appears. In *Hemibelideus*, subgenus, the paroccipital processes, though not shortened, are also strongly buttressed posteriorly and somewhat compressed; the proportions, 5.5:15, or 37 per cent.

TAXONOMY

SUBGENUS PSEUDOCHEIRUS

The skull is typically rather narrow (zygomatic width:condylobasal length, 58 to 60 per cent) and the orbits unbroadened (exception in *canescens*); palate elongate, unbroadened; alisphenoid bullae well inflated; mastoid region only slightly inflated; paroccipital processes moderately short to very much reduced (*canescens*, *pygmaeus*, etc.), their length not exceeding 35 per cent of over-all width apart; upper canines and p^{1-1} separated by diastemata; length of crowns of i^2 and i^3 subequal; p^4 unenlarged; toothrows smoothly curved from m^1 through the premolars and canine to i^1 (in contrast to the angular arrangement seen in *Pseudochirops*).

The typical species is *P. peregrinus*, in which posterior palatal openings are well developed, a very small portion of the lacrimal is exposed on the face, the paroccipitals are of moderate length, the orbits are unenlarged. The greatest width across the zygomata comes near their middle, not at the orbits as in *canescens.*

The degree of divergence of various other species of the subgenus from the typical species is suggested in the accompanying phylogenetic tree (fig. 3).

A list of full species follows:

1. *laniginosus* and *peregrinus*	East Australia
2. *forbesi* and allies	New Guinea
3. *canescens* and *avarus*	New Guinea
4. *pygmaeus*	New Guinea
5. *caroli*	New Guinea
6. *rubidus*	Southern Queensland
7. *victoriae*	Southeastern Australia
8. *convolutor*	Tasmania
9. *occidentalis*	Western Australia
10. *herbertensis*	Northern Queensland

Those species nearest the bottom of the list diverge more strongly and in more numerous ways from *laniginosus*. *Pseudocheirus herbertensis* is distinguished by the absence of posterior palatal openings, and by the exceptionally large facial exposure of the lacrimal bone and extreme degree of reduction of the interparietal; *P. convolutor*, by the unusually wide palate, absence of posterior palatal openings, and by great lengthening of the nasals anteriorly, with deepening of the nasal notch; *P. occidentalis*, with very large posterior palatal openings, has also long anterior openings which extend backward beyond the anterior roots of p^3; the rostrum is massive, high, and smoothly domed. *Pseudocheirus caroli* is distinguished by obsolescence of the posterior palatal openings, although it otherwise somewhat resembles *P. peregrinus; P. pygmaeus*, by small size and proportional enlargement of the bullae; *P. canescens*, by unusual enlargement of the orbits; *P. forbesi*, by flattening of the outer sides of the bullae, the lace-work pattern of the posterior palatal fenestrations, and lack of white tip to the tail. In *caroli*, *forbesi*, *canescens*, and *pygmaeus* the paroccipital processes are very short.

Pseudochirulus Matschie

Pseudocheirus canescens was designated by Matschie the type of this new subgenus *Pseudochirulus.* Unfortunately few of the features that were supposed to define the subgenus have generic systematic value, and he wrongly included under it the members of the *forbesi-schlegeli* group. His succeeding two "new species," *capistratus* and *barbatus,* appear to be conspecific with *forbesi.* The tiny species *pygmaeus,* which Klein placed in "*Pseudochirulus,*" is not closely related to *canescens.* Thus, if Matschie's subgeneric concept is to be retained for *canescens* and allies, it must be closely defined and based primarily upon structural differences between *canescens* of Vogelkop and *peregrinus* of Australia. In my opinion insufficient differences of subgeneric weight exist. The one character that might be cited in support of such separation is the extreme shortness of the paroccipital processes, but that character was not mentioned by Matschie.

Pseudocheirus peregrinus Boddaert

Pseudocheirus Ogilby (September, 1837a) was founded upon two marsupials, *Phalanger cookii* Ogilby and *gliriformis,* which latter is a species of *Dromicia.* But *Phalanger cookii* Ogilby (1836), an Australian species, was indicated by that author as a species distinct from the older *Phalangista cookii* Desmarest (1818) from Tasmania, the latter having been renamed by Ogilby *Phalangista viverrina.* Under the International Rules of Nomenclature, Article 30, the type of a genus must be one of the species included by the founder in that genus. The fact that *gliriformis* was a *Dromicia* indicates definitely that *cookii* Ogilby from Hunter River, New South Wales, is the type of *Pseudocheirus.* Since this name is a homonym it cannot be used, but must be replaced by the next available name, *laniginosus* Gould, which likewise was applied to specimens from Hunter River. Thomas' (1888) and Matschie's (1915) designations of *peregrinus,* a different race, as type of *Pseudocheirus* can hold if, as I believe, *peregrinus* and *laniginosus* are conspecific. The type of *Pseudocheirus* must then be written: *Pseudocheirus cookii* Ogilby (not Desmarest) = *laniginosus* Gould = *peregrinus* Boddaert.

Earlier (1937) I accepted the designations by Thomas (1888) and Matschie (1915) of *peregrinus* Boddaert as type of the genus. Troughton (1941) has since treated *peregrinus,* the gray form of the coastal scrubs of north Queensland, as a species fully distinct from Ogilby's type *cookii.* The precise identification of the original *peregrinus* with topotypes from near Cooktown is not in doubt (see beyond). The real question relates to the conspecificity of *peregrinus* and *cookii* Ogilby = *laniginosus.*

Pseudocheirus peregrinus agrees with *laniginosus* in the general form of the skull, the well-developed posterior palatal openings, the moderately developed paroccipital processes, the rather large meatal openings, the general dental pattern. It differs slightly by its somewhat smaller alisphenoid bullae, particularly in the degree of their extension anteriorly, by the smaller size of the canine (crown lengths, 1.2:1.5), and the more compressed conditions of p^3 and p^4 (widths: p^3, 1.5:1.9; p^4, 2.1:2.4).

Although the colors of the skins of the two forms, *laniginosus* and *peregrinus,* contrast strongly, it can be noted that *incanens,* the southern race of *peregrinus,* is in part annectant, having the limbs tan colored. In fact, the three races of *peregrinus* in the north, joined with those of *laniginosus* farther south, appear to indicate the almost continuous pattern of distribution in eastern Australia of a single species.

The validity of this view must rest in part upon the relationship of *P. p. oralis* from "mid-east Queensland," the most southerly of the races of *peregrinus,* with *P. l. pulcher* from northern New South Wales, the most northerly of the races of *laniginosus.* Thomas, it will be recalled, first assigned *oralis* to *laniginosus;* Iredale and Troughton (1934) transferred it to *peregrinus.* The next geographical race to be encountered is *P. l. pulcher* Matschie from coastal northern New South Wales, *pulcher* being a new name for the warmly

Race and Region	Dorsal Color	Arms and Legs	Feet	Tail	Length of White on Tail in mm.	Face	Base of Ear	Underparts
peregrinus Coen, n. Queensland	Dark gray	Dark gray	—	Blackish gray	100	Gray	White	White with gray bases
incanens Atherton tableland, n. Queensland	Silvery gray	Tan	Pale whitish brown	Gray	200	Tan	Extensively white	White with white bases
oralis South central Queensland	Dark gray	Orange cinnamon	Pale tawny	—	150	Gray tan	White	White
pulcher Coastal northern New South Wales	Gray brown	Tan	Tan	Gray brown	170	Tan	White	White with gray bases
modestus Inland New South Wales	Gray brown	Dull tan	Dull tan	Brown	120	Grayish tan	Dirty white	Dirty white with gray bases
laniginosus Hunter River, New South Wales	Brownish gray	Brownish gray	Whitish tan	Gray	75	Grayish tan	Buffy white	White with gray bases

Fig. 4. The color differences of the six races now attributed to *peregrinus*.

colored series depicted as *P. cookii* Gould. The two southern *Pseudocheirus*, *victoriae* and *notialis*, and *rubidus* from mountainous southern Queensland are treated as separate species for reasons given beyond. Under such an arrangement as I have suggested the eastern ring-tails would appear as the following races:

1. *P. p. peregrinus*	Cooktown, northern Queensland
2. *P. p. incanens*	Ravenshoe, northern Queensland
3. *P. p. oralis*	Mid-east Queensland
4. *P. p. pulcher*	Coastal New South Wales
5. *P. p. modestus*	Inland New South Wales
6. *P. p. laniginosus*	Hunter River, New South Wales

It is unlikely that the integrity of some of these geographical races, the salient characters of which are tabulated in figure 4, can be upheld any more than can that of many of our interrelated races of *Peromyscus* in the United States. Transitional forms are to be expected between one race and the next adjoining, and much study will be needed before their ranges can be determined with a reasonable degree of accuracy.

As Boddaert's (1785) original description of *peregrinus* is available to but few students, I quote it together with the slightly different earlier description of Pennant (1781): "*Peregrinus.* A Didelphis with long, pilose tail, the tip bare; body ferruginous above, white beneath. The Filander of the South. New Holland opossum. Pennant, Quadr. 311. n. 188. Habitat, on Endeavour River [at Cooktown, north Queensland]."

Boddaert based his name *peregrinus* on the New Holland opossum of Pennant (1781). The description, without technical name, given by the latter, follows:

"188 New Holland O[possum] with the upper part of the head, and the back and sides covered with long, soft, glossy hairs, of a dark cinereous color at the bottoms, and of a rusty brown towards the ends: belly of a dirty white.

"Tail taper, covered with short brown hairs, except for four inches and a half at the end, which was white, and naked underneath; toes like the former.

"The skin I examined had lost part of the face: the length from the head to the tail was thirteen inches: the tail the same

"This was found near Endeavour River, on the eastern coast of New Holland, with two young ones.* It lodges in the grass, but is not common."

Incidentally, these two descriptions, the first founded upon the second, offer an example of the manner in which small discrepancies between texts develop. Workers with mammal skins are aware also how errors in description of colors come about, for example, gray hairs of specimens become oxidized to reddish or brownish. I have before me several specimens from Coen, a few miles west of Cooktown, which agree almost exactly with Pennant's description, even to the amount of white hairs on the terminal 4½ inches of tail; they lack the "rusty brown" tips of the dorsal hairs of the body, being colored instead of unfaded, grizzled gray. The "short brown hairs" of the tail of Pennant's animal in ours are brownish gray. Other races of the same species, since described from farther south, have a greater length of the tail white and show varying amounts of tan color on the limbs. I feel fully satisfied that our Coen specimens actually represent *peregrinus* Boddaert, and in consequence that that species cannot be confused with *cookii* Ogilby.

Two forms currently placed in *peregrinus* (or *laniginosus*) which appear to me to be more aberrant, and consequently perhaps should show as species rather than as races, are the strongly rufescent *rubidus* of the Bunya Range, southern Queensland, and the pallid, densely soft-furred *victoriae*, with *notialis* from the highlands of the southeastern part of south Australia shown as a race of *victoriae*. *P. rubidus* is distinguished from all forms of *peregrinus* by its entire posterior palate and by the relative shortness of its paroccipital processes (as well as by its peculiar coloration).

Pseudocheirus victoriae, from which *notialis* differs chiefly by the greater amount of white on the tail, is distinguished from *peregrinus* and allies by the fact that the

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"* Cook's voy. iii. 586."

nasal processes of the premaxillae almost make contact with the frontals, a characteristic visible also in *rubidus* and in the Tasmanian *convolutor* but not in *occidentalis* of southwestern Australia.

Pseudocheirus rubidus Troughton and Le Souef

Pseudochirus rubidus TROUGHTON AND LE SOUEF, 1929, Rec. Australian Mus., vol. 17, p. 294, pl. 45.

Pseudocheirus laniginosus rubidus IREDALE AND TROUGHTON, 1934, Australian Mus., mem. 6, p. 26.

TYPE LOCALITY: Bunya Range, south Queensland. Miss Lawrence, in charge of the mammal collections at the Museum of Comparative Zoölogy, has kindly lent me two specimens of this interesting ring-tail, collected by Mr. Schevill at Mount Mowbullen in the Bunya Range, at 3000 feet. These dispose of any idea that *rubidus* was a unique mutant (Troughton had only one specimen). In addition to the vivid rusty red color above and below (for details consult Troughton and Le Souef, above), there are skull characters which separate it sharply from *peregrinus* which occurs both north and south of it. The obsolescence of the posterior palatal foramina and the shortness of the paroccipital processes in proportion to their over-all distance apart (3.6:16.6, or 22 per cent) are the principal ones; the teeth are larger than the northern members of *peregrinus* and about equal to those of such southern members as *P. laniginosus*. The nasal notch is not so deep.

Pseudocheirus victoriae Matschie

Pseudocheirus laniginosus victoriae MATSCHIE, 1915, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 85.

Pseudocheirus laniginosus notialis THOMAS, 1923, Ann. Mag. Nat. Hist., ser. 9, vol. 12, p. 158.

We have before us for examination two specimens, also kindly lent from the collection of the Museum of Comparative Zoölogy, which were collected by P. J. Darlington on Mount Kosciusko, in southern New South Wales, at 5000 feet. These have the tail terminally white for 130 mm. Their whitish hind feet, generally soft gray dorsal pelage, and fine white ventral fur indicate the closeness of their relationship to *victoriae* of Cape Ottway and *notialis* of Mount Lofty. The latter, though here shown in the synonymy of *victoriae*, has more white in the tail (300:100 mm.) and smaller teeth and may well be considered a good race.

The skull, as earlier stated, has, in common with *rubidus* and *convolutor*, the nasal processes of the premaxillae extended so far back that they almost make contact with the frontals. The nasal notch is, however, not deep as in *convolutor*. The posterior palatal openings are well developed.

These three occurrences, in south Australia, Victoria, and southern New South Wales, prompt me to suggest that they represent a single mountain-dwelling species peculiar to the southeastern corner of Australia. There are ranges of hills behind Cape Ottway incompletely connected to the great mountain system of eastern Australia to which Mount Kosciusko belongs. The Lofty Ranges in south Australia are widely separated from that system.

Pseudocheirus caroli Thomas

In some of its characters this species is slightly reminiscent of *P. herbertensis* of Queensland. The long, almost woolly gray hair, the white terminal portion of the tail, the narrowed, unfenestrated palate, and the arrangement and shape of other parts of the skull and of the teeth indicate rather close resemblance between *caroli* and *herbertensis*. On the other hand, the facial exposure of the lacrimal in *caroli*, much more restricted than in *herbertensis*, is much as in *peregrinus* and other species of typical *Pseudocheirus*, while the shortness of the paroccipital processes distinguishes the species, together with others in New Guinea, from all Australian species.

Pseudocheirus caroli and *P. versteegi* appear to be at most subspecifically distinct. The former came from 6000 feet on Kunupi Mountains (Menoo Valley), the latter from only 100 feet in the Noord River basin (Kloof Bivak). They may be altitudinal races.

Pseudocheirus caroli caroli Thomas

Pseudochirus caroli THOMAS, 1921, Ann. Mag. Nat. Hist., ser. 9, vol. 8, p. 357.

No new material has come into our collections since previous discussion of this form (Tate and Archbold, 1937). I have been able, since then, to examine the type specimens of both *caroli* and *versteegi;* I have also seen the series of five animals in the Berlin Natural History Museum taken in the Weyland Mountains by Stein.

Pseudocheirus caroli versteegi Thomas

Pseudochirus versteegi THOMAS, 1922, Nova Guinea, vol. 18, p. 735.

The type specimen, which I had the opportunity to study in the summer of 1937, remains unique. There is no doubt of its close relationship to *caroli,* from which it differs mainly by the shape of the nasals (length by breadth in *caroli,* 17 mm. by 10.2; in *versteegi,* 20.5 by 8.5), and in the amount of white at the tip of the tail, 100 mm. in *versteegi,* about 190 mm. in *caroli.* As in *caroli* the palate is unfenestrated posteriorly.

Pseudocheirus forbesi Thomas

This name is used to include a group of ring-tails, all natives of New Guinea, derived from the old ancestral line leading to *peregrinus.* In them, however, the posterior palatal openings, though extensive, appear as very many small pores in a network of bone. The outer half of each audital bulla is much flattened beneath in contrast to the inner half, which is well inflated. The paroccipital processes are very short. The tail lacks the white tip. The face and feet are more or less tan-brown, and a blackish median line may be present on the head. A black area at the angle of the jaw may be continued upward behind the ear. The underparts are buffy to white, and their hairs have gray bases.

Five names are, in my opinion, referable to this group, though it is doubtful whether more than a single species is involved:

P. forbesi	Sogeri, 1500 feet, Astrolabe Range, near Port Moresby
P. f. longipilis	Mount Tafa, 7000 feet, near Port Moresby
P. lewisi	Arfak Mountains, 6200 feet
P. larvatus	Rawlinson Mountains, Huon Peninsula
P. barbatus	Sattelberg, Huon Peninsula

Thomas (1888) was misled by an anomaly when he wrote of the "total suppression of the posterior incisors and anterior premolars" of *P. forbesi* The premolar is rather commonly wanting, the incisor rarely.

In this species there seem to develop long-haired, high-mountain races at greater altitudes but on the same slopes as lowland races. This is exemplified by typical *forbesi* from the Astrolabe Range, 1600 feet, and its corresponding highlands race *longipilus* from 7000 feet, not very many miles away. I am inclined to regard *larvatus, barbatus,* and *capistratus* from the Huon region as synonyms of one another and as a geographical race of *forbesi; lewisi* is a distinct western race of *forbesi.* The structural similarity of these animals is brought out by comparison of their proportions (table, p. 25).

Pseudocheirus forbesi forbesi Thomas

Pseudochirus forbesi THOMAS, 1887, Ann. Mag. Nat. Hist., ser. 5, vol. 19, p. 146.

No new material has been received since we wrote about this form earlier (Tate and Archbold, 1937), except that I have studied and photographed the type. The altitudinal range seems to vary from 1600 to 6500 feet. No representative of the group was secured by the third Archbold Expedition which worked in central Netherlands New Guinea. A female which I examined at Genoa had been marked by Doria as having three pouch young.

As shown by the comparisons in the table (p. 25), the type specimen is a little smaller than usual, both in skull measurements and in the size of the teeth.

Pseudocheirus forbesi longipilis Tate and Archbold

Pseudochirus (Pseudochirulus) forbesi longipilis TATE AND ARCHBOLD, 1935, Amer. Mus. Novitates, no. 810, p. 4.

MATERIAL: Only the original two males from Mount Tafa, 6500 to 8000 feet.

The very dense silky pelage contrasts strongly with that of the series from altitudes lower than 6000 feet. It more nearly resembles the pelage of specimens of *P. f. larvatus* but lacks the brilliant color pattern of that Huon Peninsula race.

Pseudocheirus forbesi larvatus (Förster and Rothschild)

Phalanger larvatus Förster and Rothschild, 1911, Ann. Mag. Nat. Hist., ser. 8, vol. 7, p. 337.

Pseudochirulus capistratus Matschie, 1915, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 92.

Pseudochirulus barbatus Matschie, 1915, *ibid.*, p. 93.

Material Examined: The types of *larvatus, capistratus*, and *barbatus*, as well as the series of three specimens recorded previously (Tate and Archbold, 1937).

The two types of *P. larvatus* (B.M. No. 28.10.1.22, adult male, and B.M. No. 11.10.13.2, young adult male) were both collected by Keysser in the Rawlinson Mountains, Huon Peninsula. The skins are more brilliantly colored than those of true *forbesi*, the face bright chestnut, with black facial stripes extending from the chin, behind the cheeks, to the bases of the ears. Underparts dirty white, the hairs with gray bases; the chin fuscous.

Palate fenestrated in much the same manner as in *forbesi*, a reticulate pattern. The meatus nearly smooth beneath, the alisphenoid bullae not very prominent.

The type of *P. barbatus* (Berlin No. A. 107,06,2) was also collected by Keysser. It is an unsexed skin, without skull. Head and face light brown, with median fuscous stripe. Forearms light brown. Underparts dirty white, the hairs with gray bases. Chin fuscous, the dark color continuing behind the brown of the face to the base of the ear. Hind legs and feet brownish gray.

The measurements of representatives of this race are compared with others of the group (table, p. 25). They suggest that it is on the average slightly larger than any of the others.

The type of *P. capistratus* (Berlin No. 20751, juvenal female) has the fuscous chin and whitish underparts that characterize the members of the *forbesi* group in the Huon area. The skull, though juvenal, shows identity of dental pattern with our series, particularly in the dimensions of m^1, which compare favorably with those in other species from the region about the Huon Peninsula.

Pseudocheirus forbesi lewisi Dollman

Pseudochirus lewisi Dollman, 1930, Proc. Zool. Soc. London, pt. 1, p. 431.

The type of *P. f. lewisi* (B.M. No. 29.5.27.51, adult male) was collected by Shaw Mayer in the Arfak Mountains at 6200 feet. Although the ventral color pattern separates it quite definitely from the eastern representatives of *forbesi*, the characters of its skull show it to be more closely related to *forbesi* than to the similar appearing *canescens* and *avarus*.

The general color is gray with a brownish tinge. There is no frontal line, but a fuscous area appears at the base of the ears. Underparts buffy, with the hairs gray based. The posterior palate strongly fenestrated in a manner similar to *P. f. forbesi*. The mastoid and alisphenoid inflations well developed. The under surface of the meatus slightly rough but not flattened.

We have two specimens of this form in the Archbold collection, an adult male from Siwi, 2500 feet, and a juvenal female, formerly referred to *schlegeli*, from Ditschi, 3500 feet, both collected by Dr. Ernst Mayr and virtual topotypes.

Measurements of this race are shown in the table (p. 25).

Pseudocheirus schlegeli Jentink

Pseudochirus schlegeli Jentink, 1884, Notes Leyden Mus., vol. 6, p. 110.

This is apparently a very rare ring-tail. Jentink (1911) has recorded a second specimen, a female from the Hellwig Mountains, 8000 feet. He offered no detailed evidence to prove such identity, however, and I myself saw only the type at Leiden.

The type of *P. schlegeli* is an adult male, collected at "Arfak" by dealer Frank. It is a mounted skin, now brownish gray, with no trace of facial or dorsal stripe; the underparts buffy, the hairs gray based except those of throat and neck which are self-colored; hands and feet light buffy.

The skull lacks the back of the braincase; the zygomata are not more widened at the orbit than at the squamosal; the alisphenoid bullae and mastoid inflations are well developed; meatal tube flat beneath; posterior palatal fenestrations slightly developed only; back of the palate in line with back of m^{4-4}.

Jentink discussed this species in relation to *P. bernsteini* from Salawatti, from which admittedly it differs greatly. Its true relationships seem to be with the *forbesi* group, or perhaps it is annectant between that and the *canescens-avarus* group. It appears to be distinct from *lewisi* which also is from Arfak.

Pseudocheirus pygmaeus (Stein)

Pseudochirulus pygmaeus STEIN, 1932, Zeitschr. f. Saugetierk., vol. 7, p. 257 (published December 15, 1932).

Pseudochirus mayeri ROTHSCHILD AND DOLLMAN, 1933, Proc. Zool. Soc. London, for 1932, p. 1083.

TYPE LOCALITIES: *Pseudocheirus pygmaeus*, Sumuriberg, Weyland Mountains; *mayeri*, Gebroeders, Weyland Mountains.

A thoroughly distinct species of which we now have a very fine series of 40 specimens from the neighborhood of Mount Wilhelmina, collected by the third Archbold Expedition. Study of the types of *pygmaeus* and *mayeri* has convinced me that they are synonymous. This species is an animal of the high mountains, being found from 6000 to 12,000 feet. The smallest known species of the genus, it is never theless referable to *Pseudocheirus* subgenus, as it shows all the characters of that group, including the large posterior palatal openings. The bullae are large and well inflated, the mastoid area somewhat less so. The width across the meatal tubes substantially exceeds the mastoid width. The paroccipital processes, as in *caroli* and *forbesi*, are extremely short—mere knobs. The only species with which this little species may be confused is *P. bernsteini*, which has also very small teeth but broader zygomata and palate and wider orbits.

The type of *P. pygmaeus* (Berlin No. 44278, adult female) has a diastema either side of the canine; posterior palatal foramina large; mastoid but little expanded; bullae prominent beneath; pelage dense, woolly, grayish brown; underparts buff with gray hair bases; hands and feet brownish buff; head slightly browner than back; no median stripe.

The type of *P. mayeri* (B.M. No. 33.6.1.61, old adult female) from 6000 feet, "found in nest of moss three feet from ground. One young in pouch," has the color of the pelage substantially as above; the skull with back of palate broken; toothrow in a smooth curve; alisphenoid bullae rounded; outer width across paroccipitals, 12.8 mm.

A set of measurements of 10 animals is appended (table, p. 25–26) which illustrates the stability of the species and will serve as a standard with which others can be compared.

Pseudocheirus canescens (Waterhouse)

The named forms of *Pseudocheirus*, which I believe are conspecific with *canescens*, are *dammermani* from western New Guinea, *avarus* from near Port Moresby, and *gyrator* from the Gira River district northeast of Port Moresby across the Central Range. Such a relationship, if verified, would give to *canescens* a range throughout the hilly areas of New Guinea, approximately the same as that of the *P. forbesi* group, though at considerably lower altitudes. The morphological features of the group are given under the races.

Pseudocheirus canescens canescens (Waterhouse)

Phalangista (*Pseudochirus*) *canescens* WATERHOUSE, 1846, A natural history of the Mammalia, vol. 1, p. 305.

Phalanger grisonnant HOMBRON AND JACQUINOT, 1853, Voyage au Pole Sud, Zool., Mammal., vol. 3, p. 55, pl. 16.

"General colour grey-brown; underparts of body impure white; sides of face fulvous; upper surface of head with a broad, dusky, longitudinal mark...no posterior palatine openings." (Waterhouse.)

It is important to determine the identity of this, the oldest of the medium-sized species of *Pseudocheirus*, since it must be referred to one of two superficially similar but actually rather distinct groups, examples of which are *avarus* and *forbesi*.

The type, a mounted skin still in Paris in 1937, was marked No. 227 (191A); the skull, No. A2572, which has been sectioned sagittally, was kept in the Department of Anatomy. A cast of the skull in plaster is in the British Museum collection (see No. 7 of the Hombron and Jacquinot plate). Although Waterhouse (1846) had obviously seen the Hombron and Jacquinot plate, it is not apparent that he had seen their manuscript.

This animal resembles *P. avarus* structurally; the greatest width of the skull occurs at the orbits; the molars, as in *avarus*, are very narrow; the back of the palate is unfenestrated; the bullae are fully inflated; the paroccipital processes are much shortened. The whitish gray of the underparts as shown in the plate are reminiscent of *P. lewisi* (of the *forbesi* group), but the text of Hombron and Jacquinot reads "... the gray white, washed with yellowish, on the lower parts." The underparts in true *avarus* are self-colored Ochraceous Buff but in Archbold material from the Mount Wilhelmina region related to *avarus*, the underparts are much as described for *canescens*.

Pseudocheirus canescens bernsteinii Schlegel

Pseudo-cheirus bernsteinii SCHLEGEL, 1866, Nederlandsch Tidschr. Dierk., vol. 3, p. 357.

This ring-tail is based upon two "cotypes" in the Leiden Museum: specimen "a" an adult female, specimen "b" a juvenal male—both from the Island of Salawatti, the western tip of New Guinea.

In Schlegel's opinion, this form was related to *canescens*. Thomas synonymized the two, and the present investigation has also indicated that *bernsteinii* belongs to the *canescens-avarus* group of *Pseudocheirus*. Schlegel distinguished it by the presence of a large spot on the side of the neck and by its greater frontal concavity.

The female cotype, now brownish gray, still shows a distinct frontal stripe and a definite median dorsal shade; underparts buffy, almost without gray bases to the hairs (originally "yellowish white," Schlegel).

The skull has the rostrum short and pointed. A pronounced flare is apparent at the maxillary root of the zygomata, and the greatest zygomatic width occurs at the level of the orbits; mastoid swellings moderate; under surface of meatus rough; bullae strongly inflated; palate extending 2 mm. behind m^{4-4}, and provided with a pair of very small posterior openings like those sometimes present in *avarus*, quite unlike the bony lace-work effect in the palate of *forbesi*.

The measurements of the teeth of both cotypes (table, p. 26) indicate their relationship to the narrow-toothed *canescens* group and their distinctness from the *forbesi* group with its broader molars—indeed their teeth are exceptionally narrow.

This form should also be compared with the mountain-dwelling *pygmaeus*, which has, however, far narrower zygomata and palate, though its molars are somewhat broader.

Pseudocheirus canescens dammermani Thomas

Pseudochirus dammermani THOMAS, 1922, Nova Guinea, vol. 13, p. 736.

This is at best a weakly separable race of *canescens* from the foothills south of the "Nassau" portion of the Central Range in Netherlands New Guinea. As can be seen from the measurements of the types of *canescens* and *dammermani* and specimens from the Idenburg River (table, p. 26), there is virtually no difference. In the unique *dammermani* the length of m^1 is disproportionately small, though even that can be matched in the race *gyrator* from 500 miles to the east. Its describer compared it with *schlegeli* of the *forbesi* group, naturally being able to find a number of differences.

Pseudocheirus canescens gyrator Thomas

Pseudochirus gyrator THOMAS, 1904, Ann. Mag. Nat. Hist., ser. 7, vol. 14, p. 401.

The type (B.M. No. 6.1.8.27, an adult male) was collected at Lindum Creek, Gira River district, northeast of the Central Range at an altitude of 600 feet by Stalker, January 15, 1904.

The general color is brownish gray, with the head, face, cheeks, and forearms pale brown, and a well-marked fuscous frontal stripe; underparts brownish buff, the bases of the hairs grayish. Ears fuscous, with dark around their bases.

In the skull the zygomata are widest at the level of the orbits; the alisphenoid bullae and the mastoid areas are inflated; no palatal fenestration occurs, and the teeth are small and narrow.

The type specimen appears to be unique.

Pseudocheirus canescens avarus Thomas

Pseudochirus avarus THOMAS, 1906, Ann. Mag. Nat. Hist., ser. 7, vol. 17, p. 329.

Pseudocheirus avarus, type (B.M. No. 6.1.26.2), was purchased from Gerrard, the animal dealer. It is a young adult male from near Port Moresby. Dorsal color pale brownish gray, with a slightly darker middorsal shade from nape to tail, which recurs on the brown head as a narrow stripe running between the eyes and the crown. The head is wholly pale, dull reddish brown, and the forelimbs are the same. Underparts self-colored brownish buff throughout. Hind feet buffy white.

The skull, as in *canescens,* is widest at the level of the orbits. The basal part of the braincase is broken away. The teeth, in comparison with those of the locally common *forbesi,* are small and narrow.

Since recording our material from Matsika (Tate and Archbold, 1937), I have personally collected another specimen from Itiki, the Astrolabe Range, 1400 feet. This animal had three well-developed young in the pouch. It will be seen from the table (p. 26), that the teeth of this specimen are slightly smaller than those of others from Matsika.

Pseudocheirus occidentalis Thomas

Pseudochirus occidentalis THOMAS, 1888, Catalogue of the Marsupialia and Monotremata in the . . . British Museum, p. 174.

TYPE: B.M. No. 41.1189, adult female, skin and skull, from Perth, King George's Sound, western Australia.

This form shows relations with *peregrinus-laniginosus* in possessing large posterior palatal vacuities and the form of the union of the mastoids to the paroccipital process, and with *convolutor* of Tasmania in its relatively very deep nasal notch, the increased size of the space between i^3 and the canine, and the generally larger size of the skull. It exhibits certain unique characters. The high, smoothly rounded rostrum with smooth transition from the nasals laterally to the maxillary, and backward to the similarly smooth, full frontal area should be contrasted with the abrupt, angular change from nasals to maxillaries in *peregrinus* and allies and the depressed frontal trough of both *peregrinus* and *convolutor.* Further unique characters include the often much enlarged anterior palatal openings which may attain a length of 8 mm. and extend backward beyond the anterior margins of p^{3-3}, and the extreme enlargement of the audital meatus which has an almost funnel-shaped aperture. Finally, the anterior margin of the coronoid process of the lower jaw rises almost vertically, and the process taken as a whole is unusually broad and strong. This condition is somewhat approximated in *convolutor,* but in *peregrinus* and allies the process is weaker.

The general interrelationship of the three species is emphasized by the common development of the white distal half of the tail, and by white patches at the bases of the ears in all (partly suppressed or replaced by buff in southern races of *peregrinus*).

The general color is dark brownish gray with darker dorsal area; underparts whitish, with the hairs gray based except those of the self-colored white chest patch and self-colored buffy patch just behind the pouch in females. In some specimens these two patches are united by a narrow line of white hairs.

The habitat of *occidentalis* in southwestern Australia, 1000 miles from any other members of its group, is a significant fact. Perhaps this species, with the other two species, *peregrinus* and *convolutor,* represents the peripherally placed descendants of a Torresian ancestral stock. It was formerly common about Perth. Alexander (1915) records it as common in the Albany district, in the extreme southwest corner of western Australia. Its distribution has been mapped by Shortridge (1909).

Besides the type in the British Museum

there are others in the Rothschild collection at Tring, and series at the United States National Museum and the Museum of Comparative Zoölogy.

Pseudocheirus convolutor (Oken)

Balantia convolutor Oken, 1816, Lehrbuch der Naturgeschichte, vol. 3, pt. 2, p. 1126.

Phalangista cookii Desmarest, 1818, Nouveau dictionnaire d'histoire naturelle, nouv. ed., vol. 25, p. 476; Desmarest, 1820, Mammalogie, p. 268.

Of this species we have for study a number of skulls collected by the late Henry C. Raven in Tasmania and several specimens lent us by the United States National Museum. That this ring-tail is specifically distinct from *laniginosus* of eastern Australia is indicated by its entire palate, more stoutly built skull, much larger nasals and very deep nasal notch, and larger teeth. The arrangement of the toothrows tends slightly to approximate that in *Pseudochirops,* and the molars also are proportionately large.

Color grayish brown above, the limbs usually washed with rufous; the underparts white with only the median line of hairs white to the roots. The backs of the ears and their bases white; the terminal 100 mm. of the tail white.

A race, *P. c. bassianus* Le Souef, has been described from Flinders Island, in the Bass Strait between Victoria and Tasmania.

It is not surprising that Ogilby, believing the form *laniginosus* of Hunter River, New South Wales, to be identical to this Tasmanian ring-tail, applied the name *cookii* to both. Externally they are astonishingly similar, but internally distinctive cranial characters separate them sharply.

Skins of *P. convolutor* can be recognized by the much more ample white area around the base of the ear, by their somewhat darker color tone, and by the strong suffusion of smoky about the sides of the face, head, and neck. The pelage is thicker and longer. In both, the terminal 100 mm. of the tail is white.

Pseudocheirus herbertensis (Collett)

Two races of this species are currently recognized. An apparently distinct third race is described beyond.

Pseudocheirus herbertensis herbertensis (Collett)

Phalangista herbertensis Collett, 1844, Proc. Zool. Soc. London, p. 353.

The two cotypes of the skulls of this animal are both represented by plaster casts, B.M. Nos. 84.8.19.3–84.8.19.4. Both were adult females. The actual specimens are probably in Christiania. A good series is contained in the Archbold collection and almost as many in a collection made by the late H. C. Raven.

Skull heavily built, proportionately narrow, with distinct interorbital trough; bullae very well inflated; paroccipital processes only moderately long, rather slender; palate narrow, scarcely ever fenestrated behind; first incisors very long. The skull is specialized on account of the greatly reduced interparietal, the greatly increased facial exposure of the lacrimal bones, and the high, narrowly vaulted form of the paired nasals. The nasals are not elongated anteriorly as in *convolutor,* nor is the nasal notch deepened especially. The frontal trough is deep.

The skin has long, soft hairs, blackish brown above, white beneath. The bare area of the tail extends in both sexes to within 2 inches of the base. In this animal a tendency to assume a pied pattern exists. In some specimens the whole of one of the forelimbs may be white, while the other is smoky colored like the back.

Pseudocheirus herbertensis colletti Waite

Pseudochirus herbertensis var. *colletti* Waite, 1899, Rec. Australian Mus., vol. 3, p. 92.

Waite recognized as a distinct race of *herbertensis* a series from Boar Pocket, Tinaroo Track, near Cairns. The animals were described as "grayer and darker" than the typical form; the hairs behind the shoulders usually tipped with white or pale yellow; the rump and colored portion of the tail black; the ears "rich rufous without." The measurements given for *colletti* all come within the range of our series of true *herbertensis.*

A series purporting to represent this race has been kindly lent for study by Miss

Barbara Lawrence, in charge of the mammal collections at the Museum of Comparative Zoology. I have difficulty in distinguishing these from the typical form and must question the validity of *colletti*.

Pseudocheirus herbertensis cinereus, new subspecies

TYPE: A.M.N.H. No. 107275, adult male, Mount Spurgeon, about 65 miles northwest of Cairns, northern Queensland, altitude 4000 feet, November 28, 1937, collector Miss Gabriele Neuhäuser. The type is a skin with skull in fair condition.

GENERAL CHARACTERS: A pale, brownish gray race of the common *herbertensis*, apparently confined to semi-isolated rain forest of Mount Spurgeon; its skull not distinguishable from that of the species.

DESCRIPTION OF TYPE: Dorsal color anteriorly Light Drab,[1] which beyond the shoulders gradually darkens to Hair Brown, the under fur being Drab Gray. Head with a short, dark, median line; ears with scanty grayish white hairs at their bases. Hands, feet, and basal part of tail Light Drab. Terminal 110 mm. of tail white. Underparts Drab Gray, with a narrow median area of ventral surface and of bases of forelimbs white (not with extensive areas of pure white as in the typical race).

MEASUREMENTS OF TYPE: Head and body, 380 mm.[2]; tail, 384[2]; hind foot (s.u.), 42[2]; skull: condylobasal length, 69; zygomatic width, 39; palatal length, 39; length of nasals, 27; mastoid width, 33; width across meatus, 35; outer width across paroccipital processes, 9.5; p^4–m^4, 18, p_4–m_4, 19.6; length of mandible from articular process, 46. Dental measurements in detail appear in the table at the end of this paper.

This race is further based upon a series of three other males and five females, all from the same locality. The females can be distinguished from the males (as described above) by having the anterior parts of the body almost as dark as the posterior; the color from Hair Brown to Benzo Brown throughout, except the face which is always pale Drab. These darker females, however, never become so dark as adults of typical *herbertensis;* their color is very like that of the pale juvenals of *herbertensis;* their underparts have the same dirty gray white with few self-colored hairs as in the males, never the strong, clean, contrasting white of females of true *herbertensis*. One of the three males, the only young adult (teeth all erupted but unworn, skull not yet fully grown), has as yet the color of the females.

This Mount Spurgeon race has the appearance of inhabiting regions of less rainfall than the saturate races *herbertensis* and *colletti*, and it came from at least 1000 feet higher. The suggestion has been made that these specimens are from the western (dry) side of Mount Spurgeon, which stands on the continental divide, in which case specimens of similarly pallid color may occur to north and south of there, provided suitable conditions exist.

SUBGENUS PSEUDOCHIROPS

This subgenus, with type *P. albertisii*, can be readily distinguished from *Pseudocheirus* by a number of characters: the anterior part of the palate and the rostrum are proportionately short, so that the premolar, canine, and incisor teeth form a row of contiguous structures, and the diastemata on either side of the canine and p^1, present in *Pseudocheirus*, are no longer apparent. The posterior part of the palate and the zygomata are much wider than in typical *Pseudocheirus*. Openings in the back of the palate may be present or absent. The mastoid region in more specialized species may be so greatly inflated as to become confluent with the fully inflated bulla. The paroccipital processes are commonly quite large. The molars are generally broad, the crown length of i^2 is almost twice that of i^3, and i^{1-1} may be as greatly enlarged as in *herbertensis*.

The subgenus, whose phylogeny is indicated by the diagram (fig. 5), is confined to New Guinea, with the exception of the species *archeri* from north Queensland, the closest relative of which appears to be *corinnae* of New Guinea.

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[1] Colors are those of Ridgway, 1912, "Color standards and color nomenclature."
[2] Made by collector in the field.

Petropseudes dahli from northwest Australia, though commonly treated as a full genus, is with little doubt derived from the *Pseudochirops* stem. Its flattened, broadened head with dorsally inflated mastoid and its short tail present peculiarities, but none the less its dentition resembles that of *Pseudochirops*, not *Pseudocheirus*.

Some years ago, I pointed out (Tate and Archbold, 1937) that *Pseudochirops* consisted of two chief groups, the *albertisii* group and the *corinnae* group (= *archeri* group). The former group is now seen to comprise two distinct species, *albertisii*, in which the posterior palatal openings are small and *cupreus*, in which they are very large. In *P. cupreus* inflation of the mastoids attains maximum. This is also the largest species of *Pseudocheirus*.

The second or *archeri* group includes two distinct species, *archeri* of Cape York and *corinnae* of New Guinea, both with strongly defined blackish dorsal stripes. In *corinnae* and *archeri* the mastoids show minimal expansion and the paroccipital processes minimal development for the subgenus. In them, too, posterior palatal fenestration is absent or barely incipient.

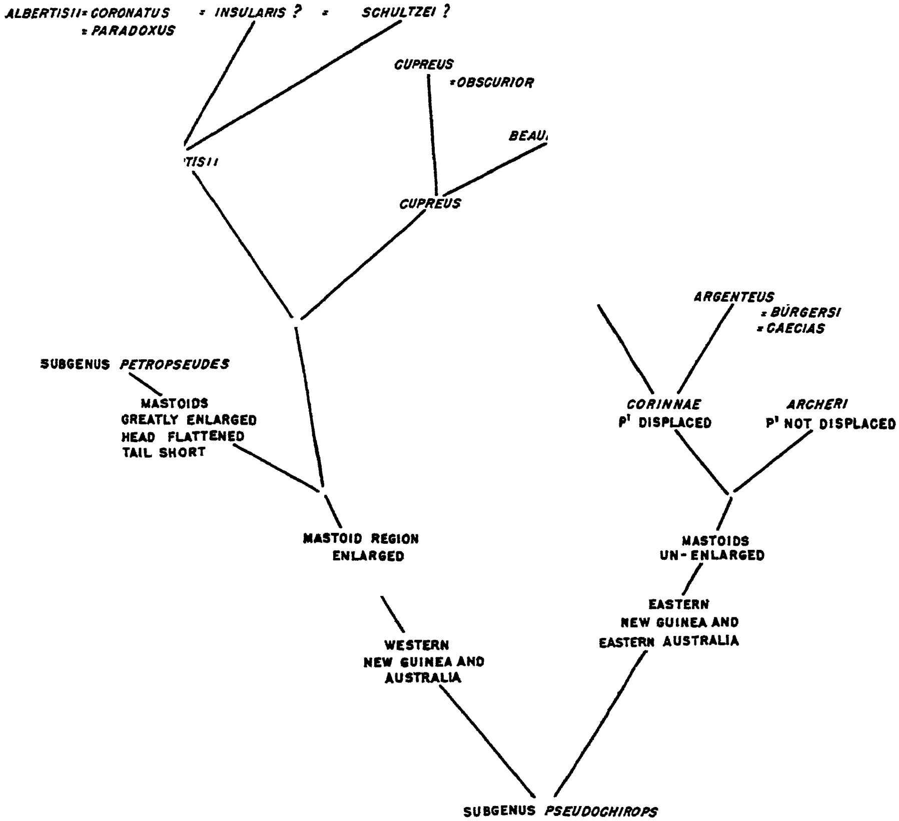

Fig. 5. Phylogenetic tree of the subgenus *Pseudochirops*, showing relationship of *Petropseudes*.

Pseudocheirus (*Pseudochirops*) *archeri* AND *corinnae* COMPARED

Pseudocheirus archeri has long been known to be the only Australian member of the Papuan subgenus *Pseudochirops*. It may possibly be the most primitive. It has usually been compared with *albertisii*, the genotype of *Pseudochirops*. Study, however, shows convincingly that *archeri* is related instead to another species of *Pseudochirops*, *corinnae* (with its supposed races *caecias*, *bürgersi*, and *argenteus*). The animals of the *archeri* group are all distinguishable from *cupreus* by the small size of their bullae, by their little-inflated mastoid areas, and by the reduced size of their paroccipital processes. The posterior palatal openings are so little enlarged as to be merely pore-like, a condition shared by *P. albertisii paradoxus* and *P. a. coronatus*.

The skins have either one or three longitudinal lines, the median line separated from the lateral ones by a pair of ill-defined whitish lines. The dorsal pelage is commonly a yellowish gray or greenish gray (except the race *caecias* which is brownish), and the tips of the hairs are grizzled silvery. All have a pale shade behind the shoulder, which runs up from the light-colored ventral region.

The altitudes occupied by true *archeri* in Queensland seem to vary from 2400 to 3000 feet. Those of *corinnae* in New Guinea extend much higher, from 3600 to 6500 feet, and in the Mount Wilhelmina region as high as 8000 feet. The unique specimen of *caecias* from the Mambaré basin came from 3000 feet, *argenteus* from 2800 to 3200 feet. The altitude on the Schrader Mountains where *bürgersi* was taken has not been recorded. Between the nearest points of the present areas of distribution of *archeri* and *corinnae* lies a gap of 300 miles of lowlands, including the Torres Strait, believed unoccupied by any member of the group.

Pseudocheirus (Pseudochirops) archeri (Collett)

Phalangista (*Pseudochirus*) *archeri* Collett, 1844, Proc. Zool. Soc. London, p. 382.

The type or cotypes of *P. archeri*, kept in the Natural History Museum, Christiania, according to Thomas (1888), are represented in the British Museum by two plaster casts numbered B.M. No. 84.8.19.5 and B.M. No. 84.8.19.6, adult males. The originals were collected by Lumholtz in northern Queensland at Herbert Vale, 15 miles from the coast, near Cardwell.

Compared with *P. corinnae* of New Guinea, *archeri* differs by several characters: the muzzle at the lacrimal level and the palate are distinctly wider; the anterior part of the mesopterygoid fossa is broader (9:8 mm.); the teeth are substantially heavier (table, p. 27). An outstanding character is seen in the relatively unreduced lower premolar between the incisor and p_4. In all other species known to me these vestigial teeth have undergone far greater reduction. The dorsal lines, at least in our small series of six specimens, are less defined; the terminal part of the tail is white, and the underparts and inner sides of the limbs are white. Nevertheless, the two species show very close affinity of structure and color pattern and are undoubtedly derived from common ancestry.

The six specimens of *archeri* in the American Museum were collected at Lake Barrine, 2400 feet, and at Evelyn, 3000 feet, both places near Cairns.

Pseudocheirus (Pseudochirops) corinnae Thomas

Of the four names applied to animals of this species, there is no doubt some are synonyms. Those names include *corinnae* proper from the upper Vanapa River, near Port Moresby; *caecias*, from the upper Mambaré River, on the northeast slope of the Central Range, behind Port Moresby; *argenteus*, from the Sattelburg, Huon Peninsula; and *bürgersi* from the Schrader Mountains, south of the divide between the Ramu and Sepik rivers, and thus a part of the northern face of the Central Range.

The fact that our collection has recently been enriched by the arrival of a series of 11 specimens from the Bele River, 6800 to 8000 feet, whose waters flow south to the Noord River, and that these animals appear to be indistinguishable from our old material from near Port Moresby, several hundreds of miles to the southeast, indicates the great stability of the form living on the southern slopes of the Central Range.

After examining the type material of all four alleged forms, I am inclined to recognize only two weakly distinct races, a northern and a southern. The color of the typical (southern) race is predominantly silvery gray with touches of tawny; that of the northern has much more brown. The underparts in all are light brownish gray, with gray hair bases, in contrast to the pure white underparts of the Australian *archeri*.

Pseudocheirus (Pseudochirops) corinnae corinnae Thomas

Pseudochirus corinnae THOMAS, 1897, Ann. Mus. Civ. Genova, ser. 2, vol. 18, p. 142.

Several cotypes exist: Genoa C. E. No. 10458 (skin) with C.E. No. 17630 (skull), adult, probably female; Genoa C.E. No. 10459, male skin with partly cleaned skull; and B.M. No. 97.8.7.86, adult male. All were collected by Loria in the upper Vanapa River basin. In addition, we have the small series previously reported, and a series of 10 specimens from the neighborhood of Mount Wilhelmina. I, myself, when traveling between Port Moresby and Kagi at the foot of Mount Victoria, did not obtain any specimens.

As stated, the new series from near Mount Wilhelmina, Netherlands New Guinea, seems inseparable from true *corinnae*. The only possible difference lies in slight obsolescence of the median dorsal line, which in two or three specimens does not extend onto the head.

Pseudocheirus (Pseudochirops) corinnae argenteus Förster

Pseudocheirus argenteus FÖRSTER, 1913, Zool. Anz., vol. 42, p. 179.

Pseudochirus bürgersi MATSCHIE, 1915, Sitzber. Gesellsch. Naturf. Fr. Berlin, vol. 4, p. 89.

Pseudochirus caecias THOMAS, 1922, Ann. Mag. Nat. Hist., ser. 9, vol. 9, p. 674.

The type of *argenteus*, though somewhat more silvery than certain other specimens from the Huon Peninsula (6200 feet) was young (m^3 not fully erupted). Some other specimens (Berlin No. 34336 and Berlin No. A-4525) from the same region are distinctly browner. The type of *bürgersi* (a flat skin, male, Berlin No. 18401) is colored rich mottled brown, with three blackish dorsal stripes and the underparts light smoky brownish gray. The type of *caecias*, a young adult female (B.M. No. 7.5.22.8) has a general wash of brown over its dorsal pattern.

The characters of the skulls seem to be identical, after allowing for differences of age and sex. The dimensions of the teeth are indicated in the table (pp. 27–28).

Pseudocheirus (Pseudochirops) cupreus Thomas

This species is undoubtedly the nearest ally of the genotype *albertisii*. It can be sharply differentiated by the relatively much larger posterior palatal foramina and by much greater expansion of the lacrimal bones on the face. In common with *albertisii* and the otherwise rather specialized *Petropseudes dahli* of northwestern Australia, it has the mastoid region very greatly inflated, in some cases to such an extent that the posterior parts of the inflated mastoids exceed the occipital condyles *backward*. In one race only, *beauforti* of the upper Noord River region, this enlargement of the mastoids has advanced somewhat less, although it exceeds markedly that part of the skull in the group of *Pseudochirops* which includes *archeri* and *corinnae*. Since no other significant characters controvert the idea, it may be considered tentatively that *beauforti* is the least specialized of the races of *cupreus*. The race *obscurior* (Tate and Archbold, 1937) is now held invalid because it was probably based upon age characters; it comes within the range of normal color variation of true *cupreus*. The form from the hills on the south side of the Idenburg Valley is included provisonally with the race *beauforti*, but may possibly be distinct, as indicated by its smaller size (table, pp. 27–28). With the exception of that one race, *cupreus* appears to be restricted to the southern slopes of the Central Range, extending between the Hellwig Mountains (with Mount Wilhelmina) and the Owen Stanley Range behind Port Moresby.

Pseudocheirus (Pseudochirops) cupreus cupreus Thomas

Pseudochirus cupreus THOMAS, 1897, Ann Mus. Civ. Genova, ser. 2, vol. 18, pp. 145–146.

Pseudochirus (Pseudochirops) cupreus obscurior TATE AND ARCHBOLD, 1935, Amer. Mus. Novitates, no. 810, pp. 3–4

The type of *cupreus* (B.M. No. 96.1.25.4), seen at the British Museum, is an old adult male collected by one of the MacGregor expeditions on the Owen Stanley Range. The back and base of the skull are both broken. The skull is one of the largest of the species (table, p. 28).

Skins of *cupreus* proper are readily distinguishable from those of the related western races by the fact that the underparts have a median area of creamy white, expanded laterally at the chest and throat and again at the inguinal region. The dark dorsal stripe, though often weak, is distinguishable in all our specimens as well as in the type. True *P. cupreus* is known as yet only from the southern face of the Central Range behind Port Moresby between altitudes of 5600 and 8600 feet.

Pseudocheirus (Pseudochirops) cupreus beauforti Thomas

Pseudochirus beauforti THOMAS, 1922, Nova Guinea, vol. 13, p. 734.

A total of five specimens from the Bele River, 6800 feet, tributary of the Balim River, which in turn empties into the Noord River, undoubtedly represents true *beauforti*, the type locality of which was the Lorentz River on the south side of the mountains at an unrecorded altitude.

A second series of three individuals taken from the mossy forest on the ridge crests between the Idenburg and Balim rivers at altitudes between 5600 and 6500 feet appears also to agree closely with *beauforti*, although all three are smaller (table, p. 29).

A third series, marked with the identical locality data of the first series, differs sharply in certain respects. Comprising three males and three females, it is larger, with its posterior palatal openings substantially larger and the back of the palate behind each foramen reduced to a slender bar; the teeth are almost as large as those of the type of true *cupreus*, but the mastoid width is in most specimens proportionately *reduced*. The skins of the adults (five out of six) are warmly rufescent, and all lack even a trace of the dark middorsal line.

I am informed by Mr. L. J. Brass, a member of the collecting party, that 6800 feet represents the bottom of the Bele Valley but that natives (who secured all the skins of *P. cupreus*) hunted up to 8000 or 8500 feet. It is possible that these rufescent individuals represent a race which inhabits somewhat higher levels than the darker, smaller *P. c. beauforti*.

In all individuals, no matter at what altitude collected, the underparts are colored more or less as described by Thomas, "pale pinkish-cinnamon," and the hairs have gray bases. No specimens show the white underparts found in *P. c. cupreus*.

Pseudocheirus (Pseudochirops) albertisii (Peters)

Phalangista (Pseudochirus) albertisii PETERS, 1874, Ann. Mus. Civ. Genova, ser. 1, vol. 6, p. 303; PETERS AND DORIA, 1880, Ann. Mus. Civ. Genova, ser. 1, vol. 16, p. 674.

Pseudochirus albertisii coronatus THOMAS, 1897, Ann. Mus. Civ. Genova, ser. 2, vol. 18, p. 144.

Pseudochirus schultzei MATSCHIE, 1915, Sitzber. Gesellsch. Naturf. Fr. Berlin, p. 87.

Pseudochirus albertisii paradoxus DOLLMAN, 1930, Proc. Zool. Soc. London, pt. 1, p. 432.

Pseudochirus insularis STEIN, 1933, Zeitschr. f. Säugetierk., vol. 8, pt. 2, p. 88.

The differences described for the three Vogelkop names listed above can all be accounted for by variations of age and molt. All three come from the Arfak Mountains, eastern Vogelkop; the typical specimen from Hatam; *coronatus* from 6000 feet; *paradoxus* from 6200 feet. I find only a single additional record for this marsupial in the Vogelkop, one from Sorong, in the northwest corner of the peninsula.

Eastward the species *albertisii* is met again in the Weyland Mountains (≐6000 feet); Stein (1933) took a specimen, which he described as *P. a. insularis*, on Japen (= Jobi) Island. No records appear between the Geelvink Bay and the Cyclops Mountains, 250 miles to the east (a single specimen without skull, taken by Mayr). A unique specimen collected by Schultze from the Sepik region, 200 miles southeast of the Cyclops, was named *schultzei* by Matschie.

It is, of course, possible that altitudinal subspecies may occur in this species, but the fact, if true, cannot be effectively demonstrated with the inadequate material at hand. In the palates of both *coronatus* and *paradoxus* the posterior openings are represented by tiny pores less than a millimeter across. In specimens of true *albertisii* from Hatam, and also in our series from the Weyland Mountains, the openings reach an average length of 3 mm. Those of the type of *schultzei* are also appreciably enlarged.

In northern New Guinea, *P. albertisii* appears to represent the larger *P. cupreus*, which extends southeastward along the central ranges between the Hellwig Mountains and the Owen Stanley Range. *P. cupreus* invariably has the posterior palatal foramina much larger, the length of the smallest being 8 mm. (in material from the south side of the Idenburg Valley at 5600 feet).

SUBGENUS **PETROPSEUDES**

Contrary to one recent writer (Thomas, 1923) and in agreement with views expressed earlier (Collett, 1895), I am satisfied that *Petropseudes* is a specialized member of the *Pseudochirops* assemblage. As shown in this paper, *Pseudochirops* consists of three main species, or species groups: *archeri*, *cupreus*, and *albertisii*. *P. albertisii*, a well-specialized species, happened to be discovered first and was selected as type of the subgenus. *P. cupreus*, too, is specialized, but in another direction—the extreme enlargement of the posterior palatal vacuities, precisely one of the special characters given for *Petropseudes*. Furthermore, the ultra-enlargement of the mastoids in this animal merely marks an extreme development of what has taken place in both *cupreus* and *albertisii*. Other specializations peculiar to itself are apparent, namely, the shortening of the tail and the flattening of the skull. Its geographical isolation in northern and northwestern Australia is yet another factor that carries weight. I am, nevertheless, not disposed to allow *Petropseudes* full generic rank, believing it co-derived with a *part* of an allied subgenus (fig. 5).

Pseudocheirus (Petropseudes) dahli Collett

Pseudochirus dahli COLLETT, 1895, Zool. Anz., vol. 13, no. 490, p. 464.

The type of this species was not seen. Notes were made from B.M. 4.1.3.72, adult male, from Nellie Creek, Northern Territory, collected by J. T. Tunney. Three other specimens were found at Perth Museum, western Australia.

The upper first incisors slightly opisthodont; only traces of diastemata before and behind c and p^1; molars very large (table, p. 29). Posterior palatal openings very large (but compare with *cupreus*); mastoid swellings exceeding the condyles posteriorly and extending upward, as stated by Thomas in his description of *Petropseudes* (1923); coronoid process narrowly falcate.

TYPE LOCALITY: Mary River, Northern Territory.

SUBGENUS **HEMIBELIDEUS**

I have suggested already that the relationship of this monotypic offshoot of *Pseudocheirus* with *Schoinobates*, the gliding member of the Phascolarctinae, may have been overemphasized. The tail, furry to the tip, with little of its under surface bare and tactile, in combination with the animal's dark gray color and somewhat broadened skull contributes to make it resemble a flying phalanger without flying membrane.

But *Schoinobates* differs from *Hemibelideus* by its large posterior palatal openings; by the very slight degree of inflation of its mastoid area, in contrast to the proportionately much greater enlargement of the bulla; and also by the lack of the inflated, cellular inferior wall of the meatus so prominent in *Hemibelideus*. A further significant difference is seen in the position of p^1, close to the canine and remote from p^3 in *Hemibelideus*, remote from the canine and very close to p^3 in *Schoinobates* (a character found in true *Pseudocheirus*). There is, however, little doubt that both are related to the *Pseudocheirus* stem, for the selenodont pattern of the molars is common to all.

Hemibelideus shows features which indicate somewhat closer relationship to *Pseudochirops* than to *Pseudocheirus:* the pronounced lengthening of the crown of i^2 in proportion to that of i^3; the general broadening of skull and palate and the tendency to lateral expansion of the mastoids. Special characters, which suggest relationships to none of the principal subgenera of *Pseudocheirus*, are the previously mentioned inflation of the lower wall of the auditory meatus, the strong anteroposterior flattening of the mastoid region, and the spacing of the canine and p^1.

Pseudocheirus (Hemibelideus) lemuroides (Collett)

Phalangista (Hemibelideus) lemuroides Collett, 1884, Proc. Zool. Soc. London, p. 385.

The cotypes of this animal are in Christiania, but in London I saw two plaster casts of them (B.M. Nos. 84.8.19.1–84.8.19.2), young adult females. They were collected by Lumholtz when he obtained the types of *P. archeri*, at Herbert Vale, north Queensland.

Tooth sizes are shown in the table (p. 30).

The long, blackish dorsal pelage and white underparts of *P.* (*H.*) *lemuroides* give it a superficial resemblance to *P. herbertensis*, which is found in the same area. It is at once distinguished by the fact that the hairs of the tail remain unappressed even at the tip.

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Spe	ality		Age	Sex	p⁴–m⁴	L.* p⁴	W.* p⁴	L. m¹	W. m¹	L. m⁴	W. m⁴	Cond.-basal Length	Zyg. Width	
P. p. peregrinus	Coen, n. Queensland	A.M.N.H. No. 108917	ad.	♂	16.9		2	4.0	3.3	3.1	2.7	57.0	34.0	
P. p. incanens	Atherton, n. Queensland	A.M.N.H. No. 107232	ad.	♂	16.1		2	4.1	3.1	3.0	2.4	59.0	34.0	
P. p. incanens	Atherton, n. Queensland	B.M. No. 22.12.18.86	ad.	♀	17.0		2	4.0	3.3	3.1	2.6	56.0	34.0	Type
P. p. oralis	Bloomsbury, e. Queensland	B.M. No. 26.3.11.28	ad.	♂	16.0		2	3.7	2.7	3.0	2.6	60.0	35.0	Type
P. p. pulcher	Coastal n. N. S. Wales	Berlin No. 5534	ad.		18.5		–	4.1	3.8	3.3	3.0	64.3	38.0	Type
P. p. laniginosu	Evelyn, N. S. Wales	A.M.N.H. No. 65422	ad.	♀	18.6	3.2	2	4.4	3.6	3.4	3.0	62.0	35.0	
P. p. laniginosu	Hunter R., N. S. Wales	B.M. No. 58.11.24.12	ad.	♂	18.5	3.0	2	4.3	3.5	3.5	3.1	—	35.2	Topoty
P. rubidus	Bunya Range, s. Queensland	M.C.Z. No. 29323	ad.	♂	17.9	3.0	2	4.3	3.4	3.3	2.9	—	—	Topoty
P. rubidus	Bunya Range, s. Queensland	M.C.Z. No. 29323	ad.	♀	17.7	3.0	2	4.1	3.3	3.1	2.8	60.0	37.0	Topoty
P. victoriae	Mt. Koskiusko, N. S. Wales	M.C.Z. No. 27952	ad.	♂	17.6	3.1	2	4.2	3.5	3.0	2.8	62.5	37.0	
P. victoriae	Cape Ottway, Victoria	Berlin No. 20698	ad.	♀	17.6	—	–	4.3	3.3	3.0	2.6	—	34.0	Type
P. victoriae	Mt. Koskiusko, N. S. Wales	M.C.Z. No. 28050	ad.	♂	18.8	3.3	2	4.5	3.8	3.1	3.0	61.0	37.0	
P. v. notialis	Mt. Lofty, s. Australia	B.M. No. 23.5.11.1	y. ad.	♂	16.0	2.6	2	3.9	2.9	2.8	2.6	60.0	35.0	Type
P. caroli	Weyland Mts., N. Guinea	B.M. No. 21.8.1.15	ad.	♂	16.2	3.1	2	3.7	3.0	—	2.8	61.0	35.2	Type
P. caroli	Weyland Mts., N. Guinea	A.M.N.H. No. 101992	ad.	♂	16.7	3.1	2	3.8	3.0	3.0	2.7	58.0	34.0	
P. caroli	Weyland Mts., N. Guinea	A.M.N.H. No. 101995	o. ad.	♂	16.7	3.0	2	3.7	2.8	3.1	2.9	60.0	36.0	
P. caroli	Weyland Mts., N. Guinea	A.M.N.H. No. 101993	o. ad.	♀	6.1	3.0	1	3.6	2.8	3.1	2.7	59.5	35.5	
P. caroli	Weyland Mts., N. Guinea	A.M.N.H. No. 101994	ad.	♀	16.8	3.1	2	3.9	3.0	3.0	2.5	60.0	35.0	
P. versteegi	Noord R., N. Guinea	B.M. No. 22.3.22.3	ad.	♀	16.5	3.1		3.9	2.9	2.9	2.7	60.3	34.0	Type
P. f. forbesi	Astrolabe Mts., Papua	B.M. No. 88.3.16.7	y. ad.	♂	13.6	2.5		3.0	2.2	2.6	2.1	49.8	29.6	Type
P. f. forbesi	Central Range, Papua	A.M.N.H. No. 104131	ad.	♂	14.2	2.5		3.2	2.6	2.6	2.4	57.0	32.0	
P. f. forbesi	Central Range, Papua	A.M.N.H. No. 104133	ad.	♂	14.6	2.7		3.4	2.7	2.7	2.3	51.0	29.5	
P. f. forbesi	Central Range, Papua	A.M.N.H. No. 104132	ad.	♂	14.4	2.7		3.3	2.4	2.7	2.4	55.0	31.0	
P. f. forbesi	Central Range, Papua	A.M.N.H. No. 104130	ad.	♂	14.6	2.5		3.3	2.6	2.9	2.5	53.0	30.0	
P. f. longipilis	Central Range, Papua	A.M.N.H. No. 104037	ad.	♂	14.6	2.6		3.6	2.7	2.7	2.3	50.0	29.0	Type
P. f. longipilis	Central Range, Papua	A.M.N.H. No. 104036	ad.	♂	13.9	2.4		3.2	2.4	2.7	2.3	53.0	31.0	
P. f. larvatus	Huon Peninsula, N. Guinea	B.M. No. 11.10.13.2	y. ad.	♂	15.4	2.4		3.5	2.5	2.9	2.6	—	32.0	Cotype
P. f. larvatus	Huon Peninsula, N. Guinea	B.M. No. 28.10.1.22	ad.	♂	15.7	2.6		3.6	2.6	3.0	2.6	—	—	Cotype
P. f. larvatus	Huon Peninsula, N. Guinea	A.M.N.H. No. 79784	ad.	♂	16.2	2.8		3.7	2.9	3.2	2.8	62.0	35.0	
P. f. larvatus	Huon Peninsula, N. Guinea	A.M.N.H. No. 79775	ad.	♂	16.0	2.8		3.5	3.0	3.0	2.8	62.0	34.0	
P. f. larvatus	Huon Peninsula, N. Guinea	A.M.N.H. No. 79776	juv.	♂	—	2.6		3.7	2.7	—	—	47.0	29.0	
P. f. lewisi	Arfak, N. Guinea	B.M. No. 29.5.27.51	ad.	♂	13.8	2.5		3.0	2.5	2.5	2.3	51.0	30.0	Type
P. f. lewisi	Arfak, N. Guinea	A.M.N.H. No. 100886	ad.	♂	13.7	2.6		2.8	2.4	2.5	2.3	51.0	28.0	
P. schlegeli	Arfak, N. Guinea	Leiden, spec. "a"	ad.	♂	5.0	2.8		3.5	2.5	2.6	2.3	—	30.0	Type
P. capistratus	Schrader Mts., N. Guinea	Berlin No. 20751	juv.	♀	—			3.6	2.8	—	—	42.0	26.0	Type
P. pygmaeus	Sumuriberg, N. Guinea	Berlin No. 44278	ad.	♀	11.8			2.6	2.0	2.2	2.0	40.0	23.0	Type
P. mayeri	Weyland Range, N. Guinea	B.M. No. 33.6.1.61	o. ad.	♀	1.6			2.5	1.9	2.1	1.8	40.0	24.0	Type
P. pygmaeus	Mt. Wilhelmina, N. Guinea	A.M.N.H. No. 109596	y. ad.	♀	1.9			2.7	2.1	2.3	1.8	43.0	25.0	

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		Catalogue No	Age	Sex	p^4–m^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Cond.-basal Length	Zyg. Width	n
P. pygmaeus	Mt. Wilhelmina, N. Guinea	A.M.N.H. No. 109600	juv.	♀	—	2.1	1.5	2.8	2.1	—	—	38.0	23.0	
P. pygmaeus	Mt. Wilhelmina, N. Guinea	A.M.N.H. No. 109605	o. ad.	♀	11.5	2.0	1.4	2.6	2.0	2.4	1.9	45.0	27.0	
P. pygmaeus	Mt. Wilhelmina, N. Guinea	A.M.N.H. No. 109608	ad.	♀	11.2	2.1	1.3	2.6	2.0	2.2	1.8	43.0	26.0	
P. pygmaeus	Mt. Wilhelmina, N. Guinea	A.M.N.H. No. 109607	ad.	♀	11.5	2.1	1.5	2.7	2.1	2.2	1.8	46.5	26.5	
P. pygmaeus	Mt. Wilhelmina, N. Guinea	A.M.N.H. No. 109601	o. ad.	♂	11.3	2.1	1.5	2.7	2.0	2.1	1.8	43.0	26.0	
P. pygmaeus	Mt. Wilhelmina, N. Guinea	A.M.N.H. No. 109599	ad.	♂	12.0	2.1	1.6	2.8	2.0	2.3	2.0	43.0	26.0	
P. pygmaeus	Mt. Wilhelmina, N. Guinea	A.M.N.H. No. 109602	ad.	♂	12.0	2.2	1.5	2.9	2.0	2.2	1.8	44.5	26.0	
P. canescens	Triton Bay, w. N. Guinea	Paris No. 227 (191A) = skin Paris No. A2572 = skull	ad.	♀	13.0	2.4	1.7	2.9	2.4	2.5	2.2	54.0	31.0	Ty
P. cane	Idenburg R., 300 ft., N. Guinea	A.M.N.H. No. 15168	ad.	♂	13.2	2.3	1.7	2.9	2.4	2.7	2.3	56.0	35.0	
P. canescen	Idenburg R., 300 ft., N. Guinea	A.M.N.H. No. 151967	ad.	♀	13.0	2.4	1.6	2.9	2.3	2.6	2.2	49.0	28.5	
P. dammer	South N. Guinea	B.M. No. 22.2.2.69	juv.		12.5	2.4	1.7	2.8	2.1	2.1	2.1	46.0	28.0	Type
P. avarus	Port Moresby area	B.M. No. 6.1.26.2	y. ad.	♂	12.0	2.1	1.4	2.6	2.1	2.3	2.0	—	30.0	Type
P. avarus	Near Port Moresby	A.M.N.H. No. 104124	ad.	♂	12.6	2.4	1.5	2.8	2.3	2.5	2.1	54.0	31.0	
P avarus	Near Port Moresby	A.M.N.H. No. 104128	y. ad.	♂	12.8	2.3	1.6	2.8	2.3	2.5	2.2	49.0	31.0	
P. avarus	Near Port Moresby	A.M.N.H. No. 108540	ad.	♀	11.0	2.2	1.3	2.7	2.1	2.5	1.9	47.5	28.0	
P avarus	Near Port Moresby	A.M.N.H. No. 104125	ad.	♀	12.5	2.4	1.6	2.8	2.3	2.4	2.2	51.0	30.0	
P. avarus	Near Port Moresby	A.M.N.H. No. 104126	y. ad.	♀	12.8	2.6	1.6	3.0	2.5	—	—	46.0	26.5	
P. gyrator	Gira R. district, Papua	B.M. No. 6.1.8.27	ad.	♂	12.5	2.4	1.6	2.8	2.1	2.1	2.1	46.0	28.0	Type
P. bernsteini	Salawatti, w. N. Guinea	Leiden, spec. "a"	ad.	♀	11.6	2.2	1.3	2.5	1.4	2.0	1.9	—	32.0	Cotype
P. bernsteini	Salawatti, w. N. Guinea	Leiden, spec. "b"	juv.	♂	—	2.3	1.5	2.8	1.6	—	—	—	—	Cotype
P. occidental	Perth, W. Australia	B.M. No. 41.1189	ad.	♀	19.7	3.2	2.5	4.7	3.8	3.7	3.4	68.6	38.4	Type
P. occidental	W. Australia	U.S.N.M. No. 237710	ad.	♀	20.3	3.4	2.6	5.0	3.9	3.8	3.3	71.0	39.0	
P. occidental	W. Australia	U.S.N.M. No. 237695	ad.	♀	20.0	3.3	2.7	4.8	3.8	3.7	3.3	68.0	37.0	
P. occidental	W. Australia	U.S.N.M. No. 237697	y. ad.	♀	19.0	3.2	2.5	4.6	3.6	3.7	3.2	66.0	37.0	
P. occidental	W. Australia	U.S.N.M. No. 237708	o. ad.	♀	19.8	3.3	2.5	4.7	3.7	3.7	3.2	72.0	40.0	
P. convolutor	Tasmania				—	—	—	—	—	—	—	—	—	Type. not n
P. viverrinus	Tasmania	B.M. No. 55.12.24.213	ad.	♀	19.4	3.4	2.5	4.6	3.8	3.7	3.2	69.0	37.0	Type
P. convolutor	Near Hobart, Tasmania	A.M.N.H. No. 65466			18.5	3.4	2.5	4.5	3.7	3.4	2.9	66.0	38.0	
P. convolutor	Near Hobart, Tasmania	A.M.N.H. No. 65478			19.1	3.5	2.6	4.6	3.7	3.4	2.8	64.0	.0	
P. convolutor	Near Hobart, Tasmania	A.M.N.H. No. 65467			19.0	3.2	2.4	4.7	3.7	3.5	3.0	67.0	.5	
P. convolutor	Near Hobart, Tasmania	A.M.N.H. No. 65474			19.0	3.4	2.8	4.8	3.9	3.5	3.3	68.5	.0	
P. convolutor	Near Hobart, Tasmania	A.M.N.H. No. 65476			19.0	3.3	2.4	4.7	3.5	3.4	3.3	66.5	.0	
P. convolutor	Near Hobart, Tasmania	A.M.N.H. No. 65477			19.0	3.4	2.5	4.7	3.7	3.3	3.2	67.5	.5	
P. convolutor	Perkins I., Tasmania	U.S.N.M. No. 238387	y. ad.	♀	18.4	3.3	2.5	4.4	3.5	3.4	3.2	63.0	.5	
P. voluto	Perkins I., Tasmania	U.S.N.M. No. 238389	ad.	♂	18.2	3.3	2.4	4.3	3.5	3.4	2.8		.0	
P. volut	Perkins I., Tasmania	U.S.N.M. No. 238390	ad.	♀	18.5	3.3	2.6	4.5	3.6	3.5	3.2		.0	

Species and Race	Locality	Catalogue No.	Age	Sex	p^4–m^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m	W. m^4	Cond.-basal Length	Zyg. Width	Remarks
P. convolutor	Perkins I., Tasmania	U.S.N.M. No. 238388	y. ad.	♂	18.3	3.3	2.5	4.5	3.7	3.5	3.0	—	36 0	
P. h. herbertensis	N. Queensland	B.M. No. 84.8.19.3	ad.	♀	17.2	—	—	—	—	—	—	70 0	37.2	Cotype, blac form
P. h. herbertensis	N. Queensland	B.M. No. 84.8.19.4	ad.	♀	17.4	—	—	—	—	—	—	70 2	37.7	Cotype
P. h. herbertensis	Evelyn, n. Queensland	A.M.N.H. No. 107187	ad.	♀	18.0	3.1	2.5	4.0	3.1	3.8	3.0	61.0	35.0	
P. h. herbertensis	Evelyn, n. Queensland	A.M.N.H. No. 107188	o. ad.	♀	17.7	3.2	2.3	3.8	3.2	3 6	3.1	69.0	37.5	
P. h. herbertensis	Evelyn, n. Queensland	A.M.N.H. No. 107189	o. ad.	♀	17.5	3.2	2.3	3.8	3 0	3 7	2.9	67.0	36.0	
P. h. herbertensis	Evelyn, n. Queensland	A.M.N.H. No. 107191	ad.	♀	17.7	3 3	2.2	3.9	3 3	3.5	2 8	67.0	39.0	
P. h. herbertensis	Dimboola, 2400 ft., n. Queensland	A.M.N.H. No. 107194	ad.	♀	16 8	3.0	2.2	4.0	2.9	3.4	3 1	66.0	37.0	
P. h. herbertensis	Dimboola, 2400 ft., n. Queensland	A.M.N.H. No. 107192	y.	♂	17 7	3.3	2.4	4.0	3.1	3.6	2.9	62.0	35.0	
P. h. herbertensis	Dimboola, 2400 ft., n. Queensland	A.M.N.H. No. 107195	ad.	♂	17.9	3.3	2.4	4.1	3.2	3.7	3.0	69.0	39 0	
P. h. herbertensis	L. Barrine, 2400 ft., n. Queensland	A.M.N.H. No. 107193	ad.	♂	17.8	3.2	2 3	4 2	3 2	3 5	3 2	70 0	36.5	
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107269	ad.	♀	18.8	3.3	2 2	4.2	3.2	3 8	3 0	65 0	36 0	Gray form
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107270	ad.	♀	18.6	3.4	2.4	4 3	3.3	3.9	3.2	68 0	37.0	
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107271	o. ad.	♀	18 2	3 3	2.3	4.2	3 3	3.5	2.9	65 5	39.0	
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107272	ad.	♀	17.5	3.1	2.3	4.1	3.2	3.4	2.9	64.0	35 0	
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107273	ad.	♀	18.5	3.3	2 3	4.2	3 3	3.8	3 0	65 0	36 0	
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107274	ad.	♂	18.2	3.2	2 4	4.1	3.2	3 8	3 2	—	36.0	
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107275	ad.	♂	18 3	3.3	2 1	4.1	3.2	3.8	3 0	69 0	39.0	Type
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107276	o. ad.	♂	18.4	3.5	2.3	4.0	3.2	3.7	3.2	—	—	
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107277	ad.	♂	18.4	3.4	2.3	4 1	3.1	3 8	3 1	68.5	37.0	
P. h. cinereus	Mt. Spurgeon, n. Queensland	A.M.N.H. No. 107240	juv.	♂	—	3.4	2.5	4.0	3.1	—	—	49 0	28.0	
P. archeri	N. Queensland	B.M. No. 87.8.19.5	ad.	♂	—	—	—	—	3.7	—	3 4	65 0	40 0	Plaster cast type
P. archeri	L. Barrine, 2400 ft., n. Queensland	A.M.N.H. No. 107196	ad.	♂	21.1	4.5	3.3	5.2	4 5	3.7	3 7	61 0	39.5	
P. archeri	L. Barrine, 2400 ft., n. Queensland	A.M.N.H. No. 107199	ad.	♂	20.9	4.3	3.1	5.0	4.0	3.8	3.6	63.0	38.0	
P. archeri	L. Barrine, 2400 ft., n. Queensland	A.M.N.H. No. 107200	y. ad.	♂	20.8	4.5	2.9	4 9	3.9	3 9	3.7	60.0	37.5	
P. archeri	L. Barrine, 2400 ft., n. Queensland	A.M.N.H. No. 107197	o. ad.	♂	20.6	4 6	3.1	4.4[a]	4 3	3.7	3.7	—	40.5	
P. archeri	L. Barrine, 2400 ft., n. Queensland	A.M.N.H. No. 107201	ad.	♀	20.7	4.5	3.2	5.2	4.1	3 9	3.5	61 0	40 0	
P. archeri	L. Barrine, 2400 ft., n. Queensland	A.M.N.H. No. 107202	ad.	♀	20.1	4.4	3.0	4.8	4.0	3.7	3.6	62 0	39 5	
P. corinnae	South of Mt. Albert Edward, Papua	Genoa C.E. 10458/-17630	ad.	♀	19.5	—	—	4.2	3.7	3.2	3 4	63 0	39 0	Type
P. corinnae	South of Mt. Albert Edward, Papua	Genoa C.E. 10459	ad.	♂	20.0	—	—	4.3	3.9	3.4	3.4	67.0	41.0	Paratype
P. corinnae	South of Mt. Albert Edward, Papua	B.M. No. 97.8.7.86	ad.	♂	20.1	4.0	2.9	4 5	4.1	3.3	3.7	66.0	41.0	Cotype
P. corinnae	Port Moresby region	A.M.N.H. No. 104111	ad.	♂	21.0	4.4	3.0	5 0	4.0	3.6	3.6	63.0	38.5	
P. corinnae	Port Moresby region	A.M.N.H. No. 104116	ad.	♂	20.5	4.2	2.9	4.9	3.7	3.5	3.6	65.0	39.5	
P. corinnae	Port Moresby region	A.M.N.H. No. 104152	ad.	♂	20.7	4.1	2.9	4.9	3.9	3.8	3.8	66.0	40.0	
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109642	ad.	♂	20.6	4.1	—	4.7	3.8	3.6	3.5	67.0	39.0	

Species and Race	Locality	Catalogue No.	Age	Sex	p^4–m^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Cond.-basal Length	Zyg. Width	Remarks
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109643	ad.	♂	19.8	4.0	2.8	4.6	3.8	3.5	3.4	67.0	39.0	
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109646	ad.	♂	20.1	4.0	2.9	4.5	3.9	3.7	3.7	68.0	40.5	
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109649	juv.	♂	—	4.0	2.9	4.7	3.9	—	—	45.5	27.5	
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109650	ad.	♂	19.7	3.9	2.8	4.5	3.8	3.4	3.3	66.0	39.0	
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109644	ad.	♀	19.8	4.0	2.8	4.7	3.7	3.5	3.2	66.0	36.0	
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109645	ad.	♀	19.4	4.0	2.9	4.4	3.6	3.5	3.3	65.0	37.0	
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109647	o. ad.	♀	20	4.2	2.8	4.4	3.7	3.6	3.3	65.0	39.0	
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109648	ad.	♀	20.3	4.2	2.9	4.8	4.0	3.5	3.3	66.0	37.5	
P. corinnae	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109651	ad.	♀	19.6	4.0	2.8	4.6	3.8	3.4	3.3	66.0	38.0	
P. corinnae caecias	Mambaré R., Papua	B.M. No. 7.5.22.8	y. ad.	♀	19.0	4.1	2.5	4.3	3.6	3.1	3.1	—	35.5	Type
P. bürgersi	Schrader Mts., N. Guinea	Berlin No. 18401	ad.	♂	20.0	—	—	4.7	3.9	3.5	3.4	62.4	40.0	Type
P. cupreus	Owen Stanley Range, N. Guinea	B.M. No. 96.1.25.4	o. ad.	♂	24.3	5.3	3.2	5.8	5.0	4.2	4.0	74.0	47.0	Type
P. cupreus	Mt. Tafa, Papua	A.M.N.H. No. 104109	ad.	♂	23.4	5.2	3.3	5.8	4.5	4.2	4.0	74.0	45.0	
P. cupreus	Murray Pass, Central Range, N. Guinea	A.M.N.H. No. 104112	ad.	♀	23.7	5.3	3.6	5.9	4.5	4.2	3.9	72.0	46.0	
P. cupreus	Murray Pass, Central Range, N. Guinea	A.M.N.H. No. 104035	juv.	♂	—	5.3	3.3	6.0	4.7	—	—	—	—	
P. cupreus	Kagi, Central Range, N. Guinea	A.M.N.H. No. 108574	ad.	♂	23.2	5.0	3.4	5.4	4.3	4.1	3.9	71.0	44.0	
P. cupreus obscurior	Mafulu, Central Range, N. Guinea	A.M.N.H. No. 104114	ad.	♀	22.4	4.8	3.3	5.4	4.3	4.1	3.7	70.0	44.0	Type
P. cupreus obscurior	Mafulu, Central Range, N. Guinea	A.M.N.H. No. 104113	ad.	♂	22.9	5.5	3.4	5.5	4.6	4.1	3.9	—	43.0	
P. cupreus obscurior	Mafulu, Central Range, N. Guinea	A.M.N.H. No. 104038	juv.	♂	—	4.8	3.3	5.3	4.2	—	—	—	—	
P. cupreus beauforti	Lorentz R., N. Guinea	B.M. No. 22.3.22.2	ad.	♂	22.5	4.9	3.2	5.0	4.2	3.7	3.6	67.1	40.5	Type
P. cupreus beauforti	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109631	ad.	♂	23.7	5.2	3.5	5.7	4.3	4.2	3.9	71.0	45.0	
P. cupreus beauforti	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109632	ad.	♂	23.5	5.1	3.4	5.3	4.5	4.4	4.0	71.0	46.0	

d Ra	Locality	Catalogue No.	Age	Sex	p⁴–m⁴	L. p⁴	W. p⁴	L. m¹	W. m¹	L. m⁴	W. m⁴	Cond.-basal Length	Zyg. Width	Remarks
P. cupreu u- forti	Bele R., L. Habbema, 7000 ft., N. Guinea	A.M.N.H. No. 109635	ad.	♂	2.8	5.0	3.7	5.3	4.5	4.0	4.0	71.0	43.0	
P. cupreu u- forti	Bele R., L. Habbema, 000 ft., N. Guinea	A.M.N.H. No. 09638	ad.	♀	3.3	5.0	3.3	5.5	4.3	4.2	3.8	70.0	43.0	
P. cupreu u- forti	Bele R., L. Habbema, 000 ft., N. Guinea	A.M.N.H. No. 09640	ad.	♀	24.5	5.2	3.3	5.9	4.9	4.1	3.7	75.0	47.0	
P. cupreu u- forti	Bele R., L. Habbema, 000 ft., N. Guinea	A.M.N.H. No. 09637	y. ad.	♀	22.5	4.8	3.4	5.2	4.3	4.0	3.8	67.0	42.0	
P. cupreus u- forti	Bele R., L. Habbema, 000 ft., N. Guinea	A.M.N.H. No. 09636	ad.	♀	21.8	4.7	3.3	5.1	4.5	4.1	3.6	71.0	44.0	
P. cupreus u- forti	Bele R., L. Habbema, 0 N. Guinea	A.M.N.H. No. 09639	ad.	♂	24.1	5.2	3.4	5.5	4.7	4.4	4.0	77.0	46.0	
P. cupreus u- forti	Bele R., L. Habbema, 7000 N. Guinea	A.M.N.H. No. 09641	ad.	♂	4.6	5.3	3.6	6.0	4.7	4.2	3.8	73.0	45.0	
P. cupreus u- forti	Bele R., L. Habbema, 7000 N. Guinea	A.M.N.H. No. 09633	juv.	♂	—	5.3	3.7	6.2	4.7	—	—	64.0	39.0	
P. cupreus u- forti	Bele R., L. Habbema, 7000 N. Guinea	A.M.N.H. No. 09634	ad.	♀	25.0	5.2	3.5	6.2	5.0	4.2	4.1	73.0	47.0	
P. cupreus u- forti	Idenburg R. area, 5 00 f N Guinea	A.M.N.H. No. 51829	ad.	♂	21.3	4.4	3.1	5.1	4.3	3.6	3.6	67.0	43.0	
P. cupreus u- forti	Idenburg R. area, 5 00 f N. Guinea	A.M.N.H. No. 51836	ad.	♂	1.4	4.5	3.1	5.2	4.1	3.8	3.5	—	41.0	
P. cupreus u- forti	Idenburg R. area, 5 00 f N. Guinea	A.M.N.H. No. 51826	ad.	♀	1.8	4.5	3.2	5.2	4.2	4.1	3.8	66.0	40.5	
Petropseude lii	Northwest Australia	B.M. No. 4.1.3.72	ad.	♂	9.6	3.5	2.7	4.9	4.1	3.1	3.6	65.7	42.4	
Pseudocheir al- bertisii	Hatam, Arfak, w. N. Guine	Genoa C.E. No. 1547	ad.	♂	9.6	—	—	4.5	4.1	3.2	3.2	62.8	36.8	Cotype
P. albertisii	Hatam, Arfak, w. N. Guine	Genoa C.E. No. 3897	ad.	♂	0	—	—	5.0	3.8	3.2	3.3	63.4	38.3	Cotype
P. albertisii	Arfak, w. N. Guinea	Berlin No. 5742	ad.	♂	5	—	—	4.5	3.8	3.1	3.0	—	38.7	
P. cor natus	Arfak, 6000 ft., w. N. Guine	B.M. No. 94.2.14.4	juv.			4.2	2.9	5.1	3.8	—	—	52.0	32.0	Type
P. par doxu	Arfak, 6300 ft., w. N. Guine	B.M. No. 29.5.27.52	ad.	♂	4	4.5	3.1	5.0	3.9	3.5	3.5	65.4	38.6	Type
P. par doxu	Siwi, Arfak Mts., N. Guinea	A.M.N.H. No. 100880	ad.	♂	5	4.1	2.9	4.8	3.8	3.2	2.9	61.5	37.5	
P. par doxus	Siwi, Arfak Mts., N. Guinea	A.M.N.H. No. 100887	ad.		0	4.0	2.9	4.4	3.5	3.3	3.2	59.5	38.0	
P. par doxus	Weyland Mts., N. Guinea	A.M.N.H. No. 103260	ad.	♂	4	3.8	3.0	4.6	3.9	3.3	3.1	65.0	38.0	
P. par doxu	Weyland Mts., N. Guinea	A.M.N.H. No. 101996	ad.	♀	5	3.9	2.9	4.6	3.4	3.0	2.7	60.5	37.0	
P. paradoxu	Weyland Mts., N. Guinea	A.M.N.H. No. 101997	ad.	♀	6	4.5	3.1	4.7	4.0	3.1	3.0	60.0	39.0	
P. insul ris	Japen I., N. Guinea	Berlin No. 44404	y. ad.	♂		3.5	3.0	4.6	4.1	3.5	3.1	—	—	Type
P. sch zei	Sepik R. region, N. Guinea	Berlin field No. 85	y. ad.	♂		—	—	4.7	3.8	—	—	57.0	26.0	Type

Species and Race	Locality	Catalogue No.	Age	Sex	p^4–m^4	L. p^4	W. p^4	L. m^1	W. m^1	L. m^4	W. m^4	Cond.-basal Length	Zyg. Width	Remark
Hemibelideus lemuroides	N. Queensland	B.M. No. 84.8.19.1	y. ad.	♀	17.1	—	—	—	3.0	—	2.8	55.0	37.6	Cotype
H. lemuroides	N. Queensland	A.M.N.H. No. 107208	ad.	♀	16.7	3.0	2.4	4.1	3.1	3.3	3.0	54.0	37.5	

AMERICAN MUSEUM NOVITATES

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NEW NEOTROPICAL DIPLOSPHYRONIDA (CHELONETHIDA)

BY C. CLAYTON HOFF[1]

During examination of the Neotropical pseudoscorpion collections of the American Museum of Natural History, the writer encountered a number of new species of the suborder Diplosphyronida. The present paper describes these new species and gives locality records for a species previously described by With (1905).

The descriptions are based on a study of unstained individuals mounted in Canada balsam. Previous to mounting, the bodies, but not the appendages, of most individuals were treated with potassium hydroxide solution. All drawings were made with the aid of a camera lucida. Measurements have been made in the manner indicated by Chamberlin (1931, his fig. 1). Type specimens are deposited in the American Museum of Natural History.

SUBORDER DIPLOSPHYRONIDA CHAMBERLIN

NEOBISIIDAE CHAMBERLIN

Ideobisiinae Chamberlin

Ideobisium balzanii With, 1905

I. Balzanii WITH, 1905, Ann. Mag. Nat. Hist., ser. 7, vol. 15, pp. 131–135, pl. 10, fig. 2a–h. *I. balzanii* CHAMBERLIN, 1930, Ann. Mag. Nat. Hist., ser. 10, vol. 5, p. 37; CHAMBERLIN, 1931, Stanford Univ. Publ., Biol. Sci., vol. 7, no. 1, p. 139, fig. 35, O. *I. balzani* BEIER, 1932, Das Tierreich, vol. 57, p. 158.

RECORDS: Two collections, each containing numerous individuals of both sexes; one collection made on June 12, 1911, from Laudat, and the other on June 21, 1911, from "Long Ditton" near Roseau, both in Dominica, British West Indies.

SYARINIDAE CHAMBERLIN

Chitrellinae Beier

PACHYCHITRA CHAMBERLIN, 1938, EMEND.

Pachychitra CHAMBERLIN, 1938, Carnegie Inst. Washington Publ., no. 491, p. 111.

The genus was established by Chamberlin (1938) to contain the species *P. maya* from Yucatan. The inclusion of *P. insularum* into the genus makes necessary a minor change in the generic diagnosis since the palps, instead of being smooth as indicated by Chamberlin in his generic description, are in part weakly granular. The presence or absence of granulations on the palpal podomeres is very probably no more than a species characteristic.

REVISED DIAGNOSIS: Carapace and abdomen smooth; carapace subrectangular to nearly square, usually little longer than wide, with a weakly developed and rounded epistomal process. Tergites and sternites entire. Lamina exterior absent; one accessory cheliceral seta present between *b* and *es;* galea slender and unbranched. Movable chelal finger with *t*, *st*, and *sb* grouped near the middle of the finger, *b* near the base; fixed chelal finger with *est* somewhat distal to the midpoint of the finger, *it* and *ist* close together and located between the levels of *et* and *est*, *ib* located dorsally near the base of the fixed finger and distinctly distad to the externally placed *isb*, *esb*, and *eb*.

Pachychitra insularum, new species

Figures 1–5

MALE: Body slender, length 1.8–2.1 mm.; abdomen and legs yellow in color, carapace and palps darker. Carapace brownish yellow; subrectangular; about

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[1] Quincy College, Quincy, Illinois. This investigation was assisted by a Grant-in-Aid from the Sigma Xi Research Fund.

0.5 mm. long; greatest width near the posterior one-third and equal to between three-fourths and seven-eighths of the length, posterior width very slightly less than the greatest width; posterior margin weakly and evenly convex; anterior margin convex except for the small, rounded epistome; lateral margins weakly convex anteriorly but subparallel and nearly straight in the posterior half; anterior margin with a long acuminate submedial seta on each side of the epistomal process and a similar seta at each lateral corner; posterior margin with perhaps six short setae; surface of carapace smooth; eyes wanting. Abdomen slender, elongate, non-granular; length 1.35–1.6 mm., width no more than one-half of the length; tergites and sternites not divided, setae short, slender, acuminate, fragile, mostly lost from specimen through storage in alcohol for many years; apparently 10 to 12 marginal setae on each tergite in the central part of the body, possibly about the same number on each central sternite. Pleural membranes wide, consisting of a number of regular parallel striations. Each stigmatic plate with two acuminate setae.

Chelicera: Surface smooth; base about 0.22 mm. long, 0.12–0.13 mm. wide; laminal seta wanting; exterior seta not so long as the width of the basal portion of the movable finger, other setae (including the extra seta near the exterior seta) very long; flagellum apparently of five setae (difficult to count accurately), the distalmost one serrate along the anterior margin; flagellum located between the bases of the two fingers. Fixed finger slender; apical tooth long, acute, and gently curved; about 12 very small and acute retroconical denticles arranged along the distal two-thirds of the inner margin of the finger, central denticles of row stronger than those near the ends; serrula interior of about 25 (difficult to count) well-separated ligulate plates. Movable finger 0.195–0.205 mm. long, slender; apical tooth acute and more curved than the tooth of the opposing finger; usually about eight acute, slender, conical denticles, variable in size, directed distad, and much better developed than those of the fixed finger; marginal teeth of movable finger confined to almost the distal one-third of the finger; serrula exterior usually composed of 28–30 ligulate plates; galeal seta long, extending far beyond the tip of the galea and inserted a little proximal to the level of the midpoint of the row of marginal teeth; galea little curved, simple, spine-like, length about equal to the width of the movable finger at the level of the insertion of the galeal seta.

Palpus: Brown color; moderately stout; weakly developed granules on the inner surface and sometimes the entire surface of the femur and on the inner surface of the tibia and hand; setae sparse, long, acuminate. Maxilla subrectangular; 0.30–0.325 mm. long, width a little more than one-half of the length; surface smooth, polished; two long apical setae with a third long seta near the base of the apical projection; two or three acuminate setae along the anterior border of the maxilla, setae otherwise sparse. Trochanter almost smooth, pedunculate; outer margin except for pedicle weakly convex to almost straight, with a few relatively long, acuminate setae; inner margin short, convex except for pedicle; length 0.21–0.23 mm., width 0.125–0.135 mm., length 1.65 to 1.75 times the width. Femur with a short pedicle well separated on the outer side from the rest of the podomere; inner margin convex in basal one-half but concave in the distal one-half; outer margin suddenly bulging near pedicle, slightly concave or straight in the center of the podomere, convex in the distal one-third; widest near the pedicle; a few acuminate setae, longer on the inner surface than elsewhere with one or two especially long pseudotactile setae in the basal one-half; length 0.42–0.475 mm., width 0.15–0.165 mm., length 2.75 to 2.95 times the width. Tibia conspicuously club shaped; pedicle slender, about twice as long as wide; podomere distal to the pedicle greatly swollen; a few acuminate setae present; inner margin distal to the pedicle markedly and evenly convex; outer margin very convex but often somewhat irregular; length 0.41–0.45 mm., length little more than twice the width. Chela smooth except for weakly granular area on inner surface of hand toward the finger base; outer margin of hand nearly straight and meeting the basal margin in almost a right angle; inner margin weakly convex; hand in dorsal view subrectangular; fingers slender; setae sparse, long, acuminate, those of the inner surface especially long; length of chela 0.675–0.74 mm., width 0.245–0.285 mm., length 2.6 to 2.8 times the width. From the side, dorsal and ventral margins of the hand appear but little convex and nearly parallel; length of hand without pedicle 0.34–0.37 mm.; depth of hand subequal to the width, ranging from 0.24–0.28 mm.; pedicle in center of base; fixed finger fairly stout and with inner margin moderately convex, outer margin weakly convex to weakly concave; movable finger slender throughout, inner margin concave, outer margin convex; length of movable finger 0.37–0.43 mm., slightly greater than the length of the hand without pedicle; chela gaping when the fingers are closed. Movable finger with about 40–45 subrectangular marginal teeth arranged along more than the distal four-fifths of the finger length; teeth little separated, cusps absent; receptor venedentis formed of the short apical tooth and three heavily sclerotized lateral and sublateral denticles located near the base of the apical tooth. Fixed finger with about 35–40 subrectangular and subcontiguous marginal teeth; some teeth with a small cusp often placed toward the proximal corner of the tooth; 10 teeth of fixed finger at level of *et* occupy about 0.06 mm. of the finger margin; teeth arranged along about the distal four-fifths of the finger margin; nodus ramosus near base of venedens and a little closer to the distal end of the apical tooth than to tactile seta *et*. Movable finger with tactile seta *st* near the midpoint of the finger, *t* about two areole diameters distal to *st*, *sb* about three areole diameters proximal to *st*, *b* about one-sixth of finger length from base of finger. Fixed finger with *et* a little less than one-fourth of finger length from tip; *est* about one and one-fourth times as far from *et* as *et* is from finger tip; *it* on a level about midway between *et* and *est* or somewhat closer to the latter; *ist* on a level slightly distal to *est; ib* about as far from *it* as the latter is from the finger tip; *isb* near base of finger and between *ib* and *esb; esb* and *eb* about three areole diameters apart and located on the external face of the chela near the base of the fingers.

Legs: Moderately slender to slender; setae not especially numerous, relatively long, acuminate; legs yellow in color; smooth. First leg with trochanter subtriangular in shape, length 0.1 mm. or less, depth somewhat less than the length, flexor margin evenly convex, extensor margin very short; pars basilis with both flexor and extensor margins weakly convex, deepest near the distal end, a few acuminate setae present, length 0.167–0.18 mm., length 1.9 to 2.1 times the depth; pars tibialis with both margins, especially the flexor somewhat more convex than the margins of the pars basilis, length 0.137–0.152 mm., length 1.65 to 1.85 times the depth; tibia with weakly concave to virtually straight extensor margin, flexor margin weakly convex, greatest depth near the center of the podomere, length 0.212–0.235 mm., depth 0.5 mm. or slightly more, length 4.25 to 4.5 times the depth; both pars tibialis and tibia with a few long, acuminate setae; metatarsus subcylindrical, deepest at the very base, a few acuminate setae present, length 0.074–0.08 mm., depth 0.034–0.035 mm.; telotarsus tapering slightly toward the distal end, length 0.125–0.137 mm., depth 0.026–0.028 mm., length 4.5 to 5 times the depth; subterminal seta of tarsus with numerous spine-like denticles along the distal two-thirds; terminal claws simple. Fourth leg with trochanter between 0.13 and 0.14 mm. long, depth about 0.1 mm., extensor and flexor margins nearly straight and parallel, few setae; pars basilis with nearly straight flexor margin, extensor margin weakly convex, a few setae on the flexor surface, length 0.17–0.18 mm., depth 0.125–0.13 mm., length 1.33 to 1.45 times the depth; pars tibialis with basal portion of flexor margin straight and continuous with the flexor margin of the pars basilis, extensor margin weakly convex, a few acuminate setae present, length 0.235–0.25 mm., depth about 1.3 mm.; entire femur 0.37–0.38 mm. long, 0.13–0.131 mm. deep, length 2.8 to 2.9 times the depth;

tibia with central and distal portions of extensor surface virtually straight, flexor margin weakly convex, a few acuminate setae present, surface near distal end may sometimes show very weak scale-like markings, length 0.31–0.325 mm., depth 0.069–0.072 mm., length 4.35 to 4.7 times the depth; metatarsus widest across the base, narrowed toward the distal end, margins nearly straight, several long and acuminate setae present, length 0.093–0.095 mm., depth 0.05–0.053 mm., length 1.8 to 1.9 times the depth; telotarsus with subterminal setae and terminal claws much as in the first leg; length of telotarsus 0.14–0.156 mm., length 4.1 to 4.2 times the depth.

Genital complex (description based on male holotype): Posterior border of third sternite with six widely spaced acuminate setae; four setae just behind genital opening on the operculum. About nine setae in a row along the posterior margin of the anterior operculum and two submedially placed just posterior to the row; in addition, a group of three setae occurs anterior to the row on each side of the median line.

FEMALE: Body in general, carapace, abdomen, pleural membranes, and stigmatic plates like those of the male as far as can be determined from the specimens at hand.

Chelicera: Base 0.215–0.235 mm. long, 0.135–0.14 mm. wide; movable finger 0.2–0.21 mm. long; galea simple, gently curved, much longer than in the male, having a length about equal to two times the width of the movable finger at the level of the insertion of the galeal seta; tip of galeal seta reaches approximately to the level of the tip of the galea; otherwise as in the male.

Palpus: Fundamentally as in the male; dimensions of chela of allotype exceeds slightly the limits of measurement determined in the males; allotype with chela 0.775 mm. long, 0.28 mm. wide, 0.277 mm. deep; hand of allotype 0.385 mm. long, movable finger 0.425 mm. long; chela of female paratype slightly smaller, ratios as in allotype. Teeth of chelal fingers, position of nodus ramosus, and nature of receptor venedentis as in the male. Tactile setae with *it* on a level much closer to *est* than to *et; ib* somewhat nearer to *it* than latter is to finger tip; otherwise as in the male.

Legs: In allotype, almost identical with the legs of the male except that some podomeres of the fourth leg vary slightly; entire femur 3 times, metatarsus 1.8 times, telotarsus 4 times as long as wide. All the pedal appendages of the female paratype are smaller than the corresponding ones of the allotype and so do not always fall within the size limits given in the description of the male. The length:depth ratios of podomeres, however, are nearly the same for the allotype and the female paratype.

Genital complex: Not favorable for study in specimens available.

TYPE LOCALITY: The male holotype, the female allotype, two male paratypes, and one paratype of undetermined sex (in alcohol) in a collection made on Desecheo Island, West Indies, in February, 1914; one male paratype and one female paratype in a collection from Mayaqüez, Puerto Rico, date unknown.

Pachychitra insularum may be separated readily from *P. maya* (Chamberlin, 1938) by the presence of granules on the palpal podomeres, the better-developed pedicle on the palpal femur, and differences in the marginal teeth of the chelal fingers.

MENTHIDAE CHAMBERLIN

Menthus mexicanus, new species

Figures 6, 7

MALE: Unknown.

FEMALE: Description based on two individuals; measurements given are of the holotype and are followed in parentheses by corresponding measurements of the paratype in instances where significant differences occur. Body slender, about 2.7 mm. in length; abdomen and legs light brown in color, carapace and palps darker brown. Cephalothorax as in the genus; carapace extending only to the level of the anterior margin of the coxae of the third leg. Carapace subrectangular, very similar to that figured by Chamberlin (1930, fig. 2, B) for *M. rossi* (Chamberlin, 1923);

dorsal surface smooth, setae sparse; anterior margin convex, well rounded, with a pair of submedial and a pair of sublateral setae; lateral margins evenly but weakly convex; minute granules seen in relief along the lateral margins; posterior margin almost straight with apparently two pairs of setae and a pair of submedial slit-like lyrifissures; posterio-lateral corners rounded; anterio-lateral corners marked by a sclerotic bar just anterior to the eyes; a weakly defined transverse furrow near the posterior margin of the carapace; two well-developed eyes on each side, the posterior eye smaller than the anterior eye; eyes of each side separated by about one-half of the diameter of the posterior eye; length of carapace 0.67 (0.77) mm., greatest width near the center and equal to a little less than 0.6 of the length; ocular width 0.325 (0.37) mm. Abdomen elongate, about 1.75 mm. long, width less than one-half of the length; sternites and tergites not highly sclerotic, not divided, each with a single marginal row of seldom more than 10 setae; all setae acuminate. Pleural membranes with numerous but weakly developed parallel striations.

Chelicera: Base relatively stout; fingers slender; moderate size. Hand of chelicera with five setae, all long and acuminate; the basal and subbasal setae somewhat shorter than the others; flagellum of four setae, the serrations of the most distal seta so sparse and fine that they are barely discernible; base of chelicera 0.21 (0.26) mm. long, 0.13 (0.16) mm. wide; movable finger 0.155 (0.19) mm. long. Fixed finger moderately slender; outer margin evenly convex; lamina exterior present; apical tooth sclerotic, with one sclerotic denticle on the inner margin near the tip and another near the base; removed some distance from the apical tooth is a row of five or six retroconical denticles along the inner margin of the finger; the distal tooth of this row is large and sclerotic, the other teeth regularly decrease in size toward the basal end of the row; serrula interior too transparent for detailed study. Movable finger slender; apical tooth heavy, very sclerotic, and dark brown in color; subapical lobe conical in shape, weakly sclerotic, often with a small terminal cusp; galeal seta inserted near the base of the subapical lobe and reaching almost to the tip of the galea; serrula exterior of about 25 ligulate teeth, the basal ones of the row longer than the others; galea bifurcated proximal to the midpoint. both rami simple and slender.

Palpus: Moderately stout, especially the chela; brown color; surface virtually smooth; numerous long, acuminate setae. Maxilla with apex long and acute; two apical setae, the more distal much longer than the other; another long seta at base of apex; setae of face of maxilla sparse, acuminate, moderately long; length of maxilla 0.38 (0.46) mm., length 2.5 (2.4) times the width. Trochanter pedunculate; inner margin irregularly convex; outer margin variable; length 0.28 (0.34) mm. long, being about 2 times the width. Femur with a weakly defined and short pedicle; outer margin convex, somewhat flattened in the central half; inner margin with basal portion convex, distal portion concave; widest near the basal third; acuminate setae fairly numerous, well scattered; length 0.475 (0.56) mm., width 0.155 (0.183) mm.; length about 3.05 times the width. Tibia with pedicle about as long as wide; outer margin of tibia very weakly convex or even straight in the basal half, distinctly convex in the distal half; inner margin irregularly convex with a slight sinuation in the distal third of the margin; chaetotaxy as in the femur; length slightly greater than the length of the femur, 0.485 (0.595) mm.; width 0.2 (0.235) mm.; length 2.43 (2.53) times the width. Chela from the dorsad with subrectangular hand; fingers slightly curved and well separated from the hand; a few acuminate setae present; chela widest near the base; both margins more or less flatly convex; chela 0.815 (0.94) mm. long, 0.295 (0.355) mm. wide; length 2.75 (2.65) times the width; length of hand without the pedicle 0.385 (0.46) mm.; length of movable finger 0.455 (0.53) mm. From the side, chelal hand has a flattened ventral margin; dorsal margin weakly convex; pedicle placed toward the ventral side of the hand; fixed finger with weakly convex inner and outer margins, narrowed toward the distal end; movable finger more slender, outer margin convex, inner margin concave; movable finger with receptor venedentis; gaping not evident when chela is closed; depth of hand 0.295 (0.37) mm. Each finger with about 35 teeth arranged along most of the finger margin; teeth in the basal portion of the row not so well developed as the more distal teeth; bases of teeth contiguous; marginal teeth slightly retroconical, especially on the fixed finger; cusps fairly well developed; apical tooth of the movable finger heavily sclerotic, dark brown in color, conical in shape; functional venedens present on fixed finger. Movable finger with four tactile setae: *t* about one-fourth of finger length from tip, *st* two-thirds to three-fourths as far from *t* as latter is from the finger tip, *sb* a little farther from *st* than *t* is from the finger tip, *b* closer to base of finger than to *sb*. External series of tactile setae of fixed finger with *et* about one-fourth of finger length from tip, *est* closer to *et* than the latter is to the finger tip; *esb* and *eb* three or four areolar diameters apart and located on the external surface of hand near base of movable finger; internal series with *it* slightly proximal to the level of *est*, *ist* little proximal to *it*, *ist* separated from *isb* by somewhat less than the distance of *et* from the finger tip, *ib* located a little proximal to the level of *isb* and separated from the latter by several areolar diameters; three accessory tactile setae[1] present: *a* dorsal to and associated with *eb* and *esb* on the external side of the hand at the base of the fixed finger, *c* and *d* well separated and located on the dorsal surface of the hand; numerous pseudotactile setae with very small areoles present on hand and fingers.

Legs: Yellow in color; surface smooth; setae acuminate and fairly numerous on the distal podomeres. First leg with trochanter little more than 1 mm. long, depth about 0.9 of the length, both flexor and extensor margins convex, the former more so than the latter; pars basilis with nearly straight margins, the greatest depth at the distal end, a few long setae present, length 0.212 (0.255) mm., 2.55 times the depth; pars tibialis with weakly convex extensor margin, inner surface swollen, setae as in pars basilis, length 0.14 (0.167) mm., 1.6 times the depth; tibia with nearly straight extensor margin, flexor margin evenly convex, acuminate setae fairly numerous, length 0.21 (0.265) mm., depth 0.061 (0.0715) mm., length 3.45 (3.7) times the depth; metatarsus subcylindrical, setae as on the tibia, length 0.102 (0.122) mm., length 2.46 (2.7) times the depth; telotarsus subcylindrical, extensor margin very weakly convex, flexor margin virtually straight, setae numerous, especially on the flexor surface, length 0.14 (0.156) mm., length 4.05 (4.3) times the depth; tarsal claws simple. Fourth leg with color and chaetotaxy as in the first leg; trochanter with highly convex extensor margin, flexor margin almost straight, length 0.175 (0.198) mm., length between 1.45 and 1.5 times the depth; pars basilis relatively small, subtriangular, a few setae near the evenly convex flexor margin, length 0.16 (0.175) mm., length about 1.35 times the depth; pars tibialis with extensor margin very convex near the basal end, flexor margin weakly convex to nearly straight, length 0.395 (0.46) mm., 2.05 times the depth; entire femur 0.475 (0.545) mm. long, 0.192 (0.225) mm. deep, length 2.45 (2.4) times the depth; tibia with flexor margin evenly convex, the extensor margin less convex than the flexor, deepest near the distal two-fifths, length 0.357 (0.41) mm., 3.7 (3.8) times the depth; metatarsus subcylindrical, slightly wider across the proximal than the distal end, length 0.159 (0.187) mm., depth about one-third of the length; telotarsus of same general shape as telotarsus of first leg, length 0.160 (0.182) mm., depth 0.042 (0.045) mm., length 3.8 (4.05) times the depth.

Genital complex: No structures of diagnostic importance observed.

TYPE LOCALITY: Two individuals, the female holotype and a female paratype, in a collection made by L. I. Davis at Mexcala, Guerrero, Mexico, on July 2, 1941.

Menthus mexicanus is the fourth species to be described as belonging to the genus. Little or no trouble is encountered in separation of our form from two of the previously described species, *M. californicus* Chamberlin, 1930, and *M. lindahli* (Chamberlin, 1923), but separation from *M. rossi* (Chamberlin, 1923) is more difficult. From *M. californicus*, our species may be separated by the larger body size, the flatter lateral and medial chelal margins, and the greater number of teeth on the movable palpal finger. The greater number of teeth in the serrula exterior, the relatively longer chelal finger, and the more slender chela distinguish *M. mexicanus* from *M. lindahli.*

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[1] Chamberlin (1931, p. 141, fig. 37, A) has designated these three accessory setae by the letters *a*, *b*, and *c*. Since his use of the letter *b* for both the basal seta of the movable finger and the central one of the accessory setae may lead to some confusion, I have taken the opportunity to redesignate the accessory setae by the letters *a*, *c*, and *d* as shown in my figure 7.

Menthus mexicanus appears to be very closely related to *M. rossi*, but on the basis of material available is considered distinct. The differences between the two forms are clearly noticeable when the females of the present species are compared with the female allotype described by Chamberlin (1923). The two most important criteria for separation of the two related species are the shape of the chela and the ratio of the lengths of the chelal finger and hand. For the female allotype of *M. rossi*, Chamberlin (1923) gives data which make possible calculations that the chela length is 3.15 times the width, and the length of the chelal finger is 1.48 times the hand length. Very similar ratios are indicated by Chamberlin in a figure published later (1931, p. 223, fig. 60). In *M. mexicanus*, the length of the chela is no more than 2.75 times the width, and the length of the finger does not exceed the length of the hand by more than 1.2 times. Moreover, the femur and tibia of the fourth leg in *M. mexicanus* are stouter than indicated by Chamberlin (1923) for these structures in the allotype of *M. rossi.*

A study of the description of *M. mexicanus* as given here indicates that numerous marked differences in size of podomeres occur between the holotype and the paratype. With the exception of the distal three podomeres of the first leg (which may be abnormal in one of the individuals) the dimensional ratios of all podomeres measured are well within the usual range of intraspecific variation. Undoubtedly ratios show less variation and are more reliable as species characteristics than are the measurements themselves. In addition, much more significance must be attached to the length : width ratios of the palpal podomeres, which in this instance are almost identical, than to the length : depth ratios of pedal podomeres, since the measurements of the small pedal podomeres allow considerable error. This error is reflected in the length: depth ratio.

OLPIIDAE CHAMBERLIN

Olpiinae Banks

Apolpium ecuadorensis, new species

Figures 8–10

MALE: Unknown.

FEMALE: Body fairly stout; appendages except for chelal hand moderately slender; all setae relatively long and acuminate; color of body yellowish brown, with palps, carapace, and tergites somewhat darker. Carapace not in a favorable position on slide for detailed measurements; length about 0.85 mm., greatest width posterior to center and considerably less than the length; posterior width little less than the greatest width; lateral margins apparently convex behind the eyes; anterior margin with a weak median sinuation and four setae, two of which are submedial in position; posterior margin almost straight with apparently four marginal setae placed somewhat anterior to the actual margin; area between setae and margin smooth and unpigmented; lateral surfaces and the posterior margin just anterior to the marginal setae marked by net-like lines; surface of carapace with about 10 acuminate setae and a few slit-like lyrifissures; eyes of the two pairs large, almost circular in outline, those of each side little separated, removed from the anterior margin by about the diameter of the eye. Abdomen subovate, about 2.15 mm. long, width about two-thirds of the length (KOH treated specimen). Number of setae on each tergite and sternite in central portion of abdomen about 10; all setae acuminate, those of the tergites longer than the sternal setae; anterior two tergites marked by net-like sculpturing, other tergites smooth; tergites darker and more sclerotic than the sternites; each tergite with a sublateral pair and a submedial pair of conspicuous slit-like lyrifissures; many sternites with a submedial pair of weakly developed lyrifissures. Pleural membranes consisting of numerous fine plications. Stigmatic plates asetaceous.

Chelicera: Base smooth, yellow; five sensory setae, *b* and *sb* shorter than others, all acuminate; flagellum of three setae, the two proximal ones subequal in length and much shorter than the third, the longest seta finely serrate, at least distally along the anterior margin, the other two setae appear smooth; length of chelicera 0.265 mm., width of base about 0.175 mm. Fixed finger with well-developed lamina exterior; apical tooth short, somewhat blunt, brown in color; apical tooth with two shallow, conical teeth on inner surface; inner margin of finger with five retroconical teeth, forming an almost continuous series with the denticles of the apical tooth and confined to less than the distal one-half of the finger; the distal plate of the serrula interior slender, elongate, almost spinelike, directed distad, with a very finely serrate margin; remainder of plates fused into a velum, in which the vestigial plates are outlined; velum very wide in the proximal half. Movable finger slender, not greatly curved, distal half with inner and outer margins subparallel; length of finger 0.225 mm.; apical tooth acute, dark in color; subapical lobe conical and placed near base of apical tooth at same level as insertion of galeal seta and galea; galeal seta shorter than the galea; galea relatively slender and straight, trifid in the distal one-fifth with branches simple, gently curved, and fingerlike; serrula exterior of about 23 to 25 ligulate plates, the position of the finger precluding an accurate count.

Palpus: Moderately slender except chelal hand; golden brown color, polished, smooth. Maxilla about 0.5 mm. long; four apical and subapical setae, another just medial to articulation with the trochanter, other setae sparse. Trochanter subtriangular; inner margin well rounded, outer margin short and weakly concave; numerous setae on inner surface; greatest width of trochanter 0.235 mm., length a little greater than the width. Femur with pedicle barely indicated; outer margin almost straight except for a sinuation at the region of the pedicle and a distal convexity; inner margin very weakly convex except near each end; setae all acuminate, fairly numerous, those of the inner surface longer than those of the outer surface; a dorsal sensory seta in the basal third; femur widest near the distal fourth; length 0.85 mm., width 0.22 mm., length equal to 3.85 times the width. Tibia with outer margin weakly and irregularly convex, greatest convexity near distal one-fourth, central portion of margin flatly convex; inner margin centrally bulging, a concavity in the region of the pedicle, a weak sinuation in the distal one-fourth; pedicle longer than wide; length of tibia 0.755 mm., width 0.247 mm., length 3.05 times the width. Chela from the dorsad with pedicle displaced far to the outer side; outer margin from pedicle to base of fingers weakly convex, being slightly more convex near the pedicle than elsewhere; inner margin tumid, a little more convex near pedicle than near the fingers; numerous, fairly long acuminate setae; fingers very slender, gently and evenly curved; chela 1.47 mm. long, 0.465 mm. wide, length 3.16 times the depth. Chela from the side with hand subovate; both margins evenly convex, the dorsal much more so than the ventral; pedicle displaced toward the ventral margin; depth of chela equal to the width; length of hand 0.66 mm.; both fingers slender; nodus ramosus of movable finger somewhat distal to tactile seta *t*, of fixed finger about midway between *et* and the level of *it;* venedens of each finger long, slender, and acute; lamina defensor present in the fixed finger, not observed in the opposing finger. Movable finger 0.8 mm. long, somewhat longer than the hand with pedicle; outer margin convex; inner margin weakly concave; 35 contiguous marginal teeth, a few conical at the distal end of the row, the remainder retroconical, becoming much flattened in the distal portion of the row, cusps weak or lacking; not more than the proximal one-sixth of the margin edentate; four tactile setae as follows: *t* about one-fifth of finger length from tip of finger, *st* slightly less than three-fifths of finger length from tip, *b* about one-tenth of finger length from basal margin, *sb* and *b* separated by between two and three areolar diameters. Fixed finger with a weakly convex inner margin, outer margin virtually straight except near the ends; marginal teeth contiguous, 55 in number and distributed along the entire finger margin, those of anterior three-fourths of row acute and retroconical, gradually changing to more symmetrical and rounded teeth at proximal end of row, cusps moderately well developed; tactile setae as follows: *et* within the terminal one-tenth of finger length; *it* about one-fifth of finger length from tip; distance from *it* to *ist* about equal to distance from *it* to finger tip; *est* located within the proximal one-third of the finger, about equidistant from the levels of *ist* and *eb; eb* and *esb* at very base of finger and separated by less than two areolar diameters; *isb* forming a row with *eb* and *esb* and separated from the latter by less than two areolar diameters; *ib* subdorsal in position and on a level little distal to the level of *isb*.

Legs: Slender except femora of third and fourth legs; smooth; light yellow in color; setae long and acuminate, not especially abundant except on the tarsal podomeres of the first and second pairs of legs. First leg with trochanter subtriangular, anterior or flexor margin distally convex but proximally concave, posterior or extensor margin nearly straight and somewhat short, length about 0.2 mm., slightly greater than depth; pars basilis elongate, flexor margin nearly straight and with a weak sinuation near the proximal end, extensor margin centrally concave with a convexity at the very distal end where the podomere is the deepest, length 0.4 mm., greatest depth 0.115 mm., length equal to about 3.5 times the depth; pars tibialis much shorter than the pars basilis, flexor margin very weakly convex, extensor margin evenly convex, greatest depth in distal half, length 0.19 mm., depth 0.115 mm.; tibia with extensor margin nearly straight but a little convex proximally and very weakly concave in the distal half, flexor margin evenly convex, length 0.295 mm., depth 0.078 mm.; metatarsus with inner or flexor margin virtually straight, outer margin very weakly concave, deepest at the proximal end, length 0.268 mm., depth 0.059 mm.; telotarsus of about the same shape as the metatarsus, length 0.195 mm., depth 0.04 mm.; tarsal podomeres markedly setaceous; terminal claws small and simple, arolium extending much beyond the claws and distally widened. Fourth leg with the flexor margin of the trochanter virtually straight, extensor margin very convex with a highly arched midpoint, length 0.31 mm., depth equal to two-thirds of the length; pars basilis subtriangular, almost no extensor margin, flexor margin weakly convex especially near the proximal end, length 0.247 mm., depth 0.15 mm.; pars tibialis swollen, extensor margin very convex especially in the proximal portion, flexor margin weakly convex, length 0.675 mm., depth 0.307 mm.; entire femur 0.79 mm. long, 0.307 mm. deep, length 2.57 times the depth; tibia with weakly S-shaped extensor margin, flexor margin weakly convex, deepest near the center, length 0.545 mm., depth 0.125 mm.; metatarsus with very weakly concave extensor margin and weakly convex flexor margin, narrowed toward the distal end, length 0.315 mm., depth 0.08 mm.; metatarsus with a long tactile seta about one-seventh of the length of the podomere from the proximal end; telotarsus with a very weakly concave inner margin, irregularly convex extensor margin, deepest near the center, length 0.27 mm., depth 0.053 mm.; setae of tarsal podomeres long but less numerous than those of the tarsus of the first leg; terminal claws and arolium as in the first leg.

Genital complex: Anterior operculum with three or four very slender setae on each side of the genital opening; posterior operculum relatively little modified and with a row of six marginal setae. Cribiform plates include a pair of prominent lateral plates and two median pairs; the anterior median cribiform plates larger than those of the posterior median pair; a few additional, small, and inconspicuous cribiform plates associated with the median pairs.

TYPE LOCALITY: A single specimen, the female holotype, in a collection made by F. M. Brown in March, 1939, at Banos, Tungurahua, Ecuador; altitude 1800 meters.

By virtue of its large size and certain other characteristics, our form seems more closely related to *A. cordimanum* (Balzan, 1891) than to any other species of *Apolpium*. The present species keys to *A. cordimanum* in the key given by Beier (1932). The two related forms, however, differ in many characteristics, *A. ecuadorensis* being recognized readily by the very slightly convex inner margin of the palpal femur, the greatest width of the palpal femur near the distal end rather than in the center of the femur, hand less triangular in outline when viewed from above, more convex outer margin of chela, and the narrower chela (measurements of Balzan's, 1891, fig. 28 indicate a length: width ratio of about 2.5 for the chela). In this connection, it might be well to point out that there is considerable difference in the shape of the palpal femur of *A. cordimanum* as pictured by Balzan (1891, fig. 28) and as depicted by Chamberlin (1931, p. 131, fig. 32, M) indicating that perhaps Chamberlin did not have the true *A. cordimanum* of Balzan. Our form has a palpal femur vastly different from that shown for *A. cordimanum* by either Balzan or Chamberlin.

Apolpium parvum, new species

Figures 11–14

MALE: Unknown.

FEMALE: Body and appendages moderately slender; body and legs light yellow in color, palps and carapace slightly darker; all setae acuminate; body 1.9 mm. long. Carapace light yellowish brown; posterior margin little convex and with four marginal setae separated from the posterior margin by a narrow unpigmented band, a slit-like lyrifissure just medial to each of the sublateral setae; anterior margin straight and with either six or eight marginal setae; lateral margins little convex behind the eyes; carapace abruptly narrowed and truncate before the eyes; between 20 and 24 setae on the surface of the carapace; surface smooth except for a submarginal band marked by poorly developed net-like sculpturing along the lateral margins and just anterior to the posterior marginal setae; eyes of the two pairs large, not regularly circular in outline, separated from the anterior margin of the carapace by less than the greatest diameter of one eye; carapace length 0.56 mm., greatest width 0.48 mm. at about the posterior one-fourth, posterior width subequal to the greatest width, ocular width 0.35 mm. Abdomen (KOH treated) about 1.35 mm. long, width about 0.8 mm.; tergites and sternites very weakly sclerotic, smooth except first and second tergites with weak net-like markings. First tergite with two to four setae, second with eight, third with 10, number on each central tergite about 14. About 10 setae on sternites of central part of body; sternal setae smaller than tergal setae; fourth sternite with six marginal setae forming a row in the median part of the sternite, in addition a small seta on the sternite just medial to the stigmatic plate of each side. Pleural membranes marked by fine, wavy plications. Stigmatic plates obliquely placed, asetaceous.

Chelicera: Length 0.185 mm., width of base 0.118 mm.; base moderately stout; the five tactile setae acuminate, *b* and *sb* shorter than the other three; flagellum of three blades, the longest very broad and with about 12 small lobe-like denticles along the distal half of the anterior margin, the other two flagellar blades more seta-like and each with a length equal to about one-half of the length of the longest blade. Fixed finger with wide and evenly convex lamina exterior; apical tooth acute, sclerotic, brown in color; the two denticles on the inner surface of the apical tooth retroconical and similar in shape but smaller than the four marginal teeth of the finger; denticles of the apical tooth and those of the inner finger margin form an almost unbroken series of six teeth all confined to much less than the distal half of the finger; serrula interior composed of 15 or slightly more plates, of which the distalmost plate is elongated and spine-like, other plates fused to form a velum in which the terminal portion of each plate is more or less free. Movable finger slender; apical tooth, subapical lobe, galeal seta, and galea much as in *A. ecuadorensis* except the three terminal rami of the galea appear slightly longer and less curved; serrula exterior of about 24 ligulate plates; movable finger 0.15 mm. long.

Palpus: Moderately slender; light yellow color; smooth; setae long and acuminate. Maxilla with two long setae (one apical and one subapical) and two or three smaller setae on the apical projection; length 0.32 mm., almost twice the width. Trochanter with extensor margin slightly concave, flexor margin convex, numerous setae on flexor surface, length 0.26 mm., width 0.163 mm. Femur without definite pedicle although both flexor and extensor margins show a weak concavity near the base of the podomere, distal to the basal concavity the extensor margin is virtually straight or very weakly concave becoming weakly convex in the distal one-half of the margin; the flexor margin centrally convex with a shallow concavity near the distal end; setae of flexor surface longer and more conspicuous than those of the extensor surface; sensory seta within the proximal one-third of the dorsal surface; length 0.54 mm., width 0.15 mm. Tibia weakly pedunculate, extensor margin evenly convex, flexor margin centrally convex but almost straight in the distal fifth, length 0.465 mm., width 0.173 mm. Chela from the dorsad with the extensor or outer margin evenly convex, the flexor margin more convex especially in the proximal portion; setae fairly numerous and acuminate; fingers little curved, slender; hand without pedicle 0.42 mm. long; movable finger 0.515 mm. long; length of chela 0.915 mm., width 0.265 mm., length 3.45 times the width. From the side, the dorsal margin much more convex than the weakly convex ventral margin, both margins less convex toward the finger base; depth of hand slightly greater than the width, 0.28 mm.; fingers slender, each with an acute venedens and delicate lamina defensor; fixed finger with inner and outer margins very weakly convex; movable finger with weakly convex outer margin, inner margin very weakly concave. Teeth of movable finger at the very distal end of the row small, conical, and with a cusp; gradually changing to the flattened retroconical, and acuspid teeth of the proximal end of the row; the 32 teeth dispersed along nearly the entire finger margin. Fixed finger with 47 retroconical teeth, mostly well developed but the basal ones reduced and without cusps; entire inner margin of finger bearing teeth. Movable finger with four tactile setae; *t* about one-fourth of finger length from tip, *st* about midway between *t* and base of finger, *b* and *sb* about three areolar diameters apart and located near base of finger; nodus ramosus slightly closer to tactile seta *t* than to the finger tip. Fixed finger with tactile setae arranged much as in *A. ecuadorensis; et* about one-tenth of finger length from tip, *ist* near midpoint of finger, *it* about midway between the finger tip and *ist; est* within the basal one-third of finger and on a level about midway between *ist* and *esb; isb, esb*, and *eb* forming an external row near the base of the finger, separated from one another by less than two areolar diameters; *ib* on about the same level as *isb;* nodus ramosus a little closer to *et* than to *it*.

Legs: Slender, especially the first two pairs; very light yellow in color: smooth; long acuminate setae fairly numerous especially on the distal podomeres. First leg with subtriangular trochanter, flexor margin convex, inner margin almost straight; length of trochanter 0.15 mm., depth about 0.115 mm.; pars basilis elongated, flexor margin with a small proximal concavity but otherwise weakly convex, extensor margin centrally concave and terminally convex; pars basilis deepest near the distal end, length 0.275 mm., depth 0.086 mm.; pars tibialis relatively short, both margins convex, length 0.145 mm., greatest depth in distal third equal to 0.0835 mm.; tibia with weakly convex flexor margin, extensor margin virtually straight except for a weak convexity near the proximal end, length 0.2 mm., depth 0.058 mm.; metatarsus with margins nearly straight, deepest at very basal end, gradually less deep toward the distal end, length 0.167 mm., depth 0.046 mm.; telotarsus tapering toward the distal end, flexor margin nearly straight, extensor margin weakly convex; length of telotarsus 0.137 mm., greatest depth at proximal end 0.03 mm.; terminal claws small and simple; arolium distally widened and extending well beyond the claws. Fourth leg: trochanter with a relatively straight flexor margin, extensor margin very convex and highly arched in the center, length 0.202 mm., depth 0.137 mm.; pars basilis with convex flexor margin, length 0.167 mm., depth 0.102 mm.; pars tibialis with flexor margin moderately convex; extensor margin of pars tibialis evenly and moderately convex except at the very proximal end where an angulation is formed by a sudden bending of the extensor margin to meet the pars basilis; length of pars tibialis 0.45 mm., depth 0.202 mm.; entire femur 0.53 mm. long, length 2.62 times the greatest depth which is near the center; tibia shaped like the tibia of the first leg, 0.36 mm. long, 0.085 mm. deep; metatarsus with both margins nearly straight, deepest at the proximal end, length 0.222 mm., depth 0.057 mm.; telotarsus with flexor margin very weakly concave, extensor margin slightly convex, length 0.185 mm., depth 0.038 mm.; tactile seta of metatarsus not especially well developed, located about one-sixth of the length of the extensor margin from the proximal end of the podomere; terminal claws and arolium as in the first leg.

Genital complex: Posterior operculum little modified, in present material with two marginal setae on one side and three on the other side of the median line; anterior operculum with a group of three setae on each side of the genital opening; lateral cribiform plates much larger than any of the median plates; median cribiform plates consisting of two well-formed pairs and a few very small and irregular plates; cribiform plates of the two median pairs about equal in size.

Type Locality: The female holotype is from a collection made by Dr. Strickland from silty clay soil surface litter at Non Pareil Estate, Sangre Grande, Trinidad, British West Indies, on March 3, 1944.

In the same collection occurs a very young individual possibly belonging to this species, although the nature of the galea suggests otherwise. The young individual has a single tactile seta on the movable chelal finger and three on the fixed finger. It seems inadvisable at this time to describe such an immature individual.

Apolpium parvum appears related through body size and other characteristics to *A. longidigitatum* (Ellingsen, 1910) (*fide* Beier, 1932) and *A. minutum* Beier, 1931. Our form differs from *A. longidigitatum* by having a slightly stouter and much shorter palpal femur, a greater length: width ratio of the chela, a shorter chelal finger, and a less convex flexor margin on the chelal hand. From *A. minutum* our form may be separated by the concavity near the distal end of the flexor margin of the palpal femur, the more evenly convex extensor margin of the stouter palpal tibia, and the somewhat greater length: width ratio of the chela.

Pachyolpium adiposum, new species

Figures 15, 16

Male: Unknown.

Female: Body and palpi moderately stout to stout; legs moderately slender; light yellowish brown color with palpi and carapace a little darker than the abdomen and legs; all setae acuminate; surface smooth and unsculptured except for the palpal femur, the chelal hand, and the sides of the carapace; body length 2.1 mm. Carapace with posterior margin little convex; four marginal setae separated from the true posterior margin of the carapace by an unpigmented band; lateral margins weakly convex; anterior margin weakly convex and with four long setae; carapace narrowed somewhat before the eyes; smooth except for net-like markings on the sides; setae of face of carapace not abundant, scattered; eyes large, nearly circular, separated from the anterior margin by about the diameter of the anterior eye; eyes of each pair separated one from the other by about one-half the diameter of the eye; carapace about 0.72 mm. long, greatest width in the posterior half and little less than the length, posterior width subequal to the greatest width, ocular width 0.53 mm.

Abdomen stout, length 1.38 mm., width 0.92 mm. (KOH treated specimen); tergites unsculptured, first tergite with four setae, second tergite with five, third with nine, maximum number in central tergites 12 to 14; sternites with maximum number of setae 10 to 12 in central portion of abdomen, setae somewhat smaller than setae of the tergites; fourth sternite with six or eight setae confined to the median half of the sternite and a lateral seta near each posterior stigmatic plate; anterior stigmatic plates without associated setae; pleural membranes with numerous fine plications.

Chelicera: Stout; length 0.3 mm., width of base 0.215 mm.; five long setae on base; flagellum of three stout blades, the longest denticulate along about the distal third of the anterior margin, the middle blade much shorter and with a few fine denticulations in the distal fourth, the third still shorter and with fewer denticulations. Fixed finger relatively narrow; with conspicuous lamina exterior; one or two denticles on the concave surface of the apical tooth continuous with six or seven denticles along the terminal two-thirds of the inner margin of the finger; the proximal one or two denticles of the marginal row reduced in size; serrula interior with plates fused into a velum, free plates of distal end of row not in a position for observation although the terminal plate seems to be spine-like and smooth. Movable finger stout, outer margin almost straight, inner margin evenly concave, length 0.233 mm.; serrula exterior with 24 ligulate plates, the terminal one of which is on a level with the insertion of the galeal seta; apical tooth brown, sclerotic, conical in shape; subapical lobe with a very wide base, obtuse, blunt, located on a level with the insertion of the galeal seta and very close to the apical tooth; subapical lobe appears to be indefinitely and irregularly bicuspid; inner margin of the finger near the subapical lobe and the posterior slope of the lobe itself with two or three minute denticles; galeal seta shorter than the galea; galea bifurcated near the center with the apical ramus secondarily bifurcated just proximal to its midpoint, all three branches slender and terminally acute.

Palpus: Fairly stout, podomeres except hand of chela smooth; yellowish brown color; numerous acuminate setae. Maxilla with three setae on apical projection, one distinctly apical, another subapical, the third near the base; length 0.48 mm., width somewhat greater than half the length. Trochanter with a well-marked pedicle, inner margin distal to pedicle well rounded, outer margin weakly concave; setae numerous especially on the inner surface; length about 0.405 mm., width 0.225 mm. Femur with pedicle wider than long and poorly developed; extensor margin distal to pedicle flatly convex becoming more convex near the distal third or fourth; inner margin weakly convex distal to the pedicle but becoming nearly straight in the terminal one-third; a few very fine granules on the distal half of the inner surface; dorsal tactile seta located about one-third of femur length from the proximal margin; length of femur 0.59 mm., greatest width 0.25 mm. near the center, length 2.36 times the width. Tibia very slightly longer and considerably stouter than the femur; pedicle hardly as long as wide; outer margin of entire podomere evenly convex; inner margin evenly convex distal to the pedicle; length 0.61 mm., width 0.285 mm., length 2.14 times the width. Chela with outer margin weakly convex, being less convex toward the finger base than near the pedicle; inner margin markedly but evenly convex especially near the pedicle; smooth except for fine scattered granules over a small area on the inner surface of the hand near the base of the fingers; fingers from dorsad moderately stout, gently curved; setae fairly numerous and relatively long; length of chela 1.12 mm., width 0.425 mm.; length of hand without pedicle 0.59 mm.; depth of chela about equal to the width. From the side, the chela shows a well-arched dorsal margin while the ventral margin is weakly convex in the proximal portion but virtually flat in the distal two-thirds; pedicle placed toward the ventral side of the hand; fingers stout, color darker toward the finger tips;

the fixed finger heavier than the movable, with distinctly convex inner margin, outer margin weakly concave except near tip of finger; movable finger gently curved. outer margin moderately convex, inner margin concave, length 0.61 mm.; venedens of each finger acute and very sclerotic; a lamina defensor possibly present and tightly appressed against the inner margin of each venedens. Fixed finger with 42 contiguous teeth arranged along the entire length of the margin; teeth at distal end of row retroconical with highly developed cusps, becoming much flattened and without cusps near the proximal end of the row. Movable finger with 38 teeth; the distal teeth conical and with well-developed cusps; teeth in the center of the marginal row becoming flatly rounded, those of the proximal end of the row much flattened and without well-formed cusps; row of teeth of movable finger extending from the venedens to a level between tactile setae *st* and *sb*. Movable finger with four tactile setae: *t* located slightly distal to the midpoint of the finger, *st* a little nearer the basal margin of the finger than to *t*, *b* about midway between *st* and the proximal margin of the finger, *sb* less than two areolar diameters distad of *b*. Fixed finger with *et* about one-fifth of finger length from tip; *it* near midpoint of the finger; *est* located about one-third of the finger length from the proximal margin; *ist* distinctly basal in position, located a short distance distal to *ib* and hardly at all distal to the level of *isb; isb*, *esb*, and *eb* forming a compact row on the external face of the finger near the base.

Legs: Light yellow color; smooth; acuminate setae relatively long, fairly numerous especially on the distal podomeres. First leg with subtriangular trochanter, flexor margin convex, extensor margin short and nearly straight, length 0.163 mm., depth 0.142 mm.; pars basilis elongate, flexor margin weakly convex, extensor margin with a concavity in the central half, a few long setae present, length 0.285 mm., greatest depth near the distal end 0.12 mm.; pars tibialis much shorter than pars basilis, both margins convex, the flexor more convex than the extensor, length 0.198 mm., greatest depth 0.125 mm. near the center; tibia with extensor margin weakly S-shaped, flexor margin moderately convex, setae as in the pars basilis, length 0.255 mm., depth 0.0875 mm. near the distal one-third; metatarsus subcylindrical, tapering slightly toward the distal end, deepest at the very proximal end, length 0.167 mm., depth 0.061 mm.; telotarsus with flexor margin nearly straight, extensor margin convex especially in the distal half, length 0.145 mm., greatest depth 0.05 mm. near the proximal margin; setae of tarsal podomeres more numerous and larger than on other podomeres; terminal claws simple, arolium extending beyond the terminal claws. Fourth leg with trochanter about 0.28 mm. long, nearly 0.2 mm. deep, flexor margin weakly convex, extensor margin moderately convex; pars basilis subtriangular, numerous setae on flexor surface and sides, flexor margin convex especially at the proximal end, length 0.23 mm., depth 0.163 mm.; pars tibialis with flexor margin very weakly convex, extensor margin moderately and, except for the very distal end, evenly convex, more and longer setae on the flexor surface than on the extensor, length 0.575 mm., depth 0.28 mm.; entire femur 0.68 mm. long, 0.28 mm. deep; tibia with flexor margin unevenly convex, extensor margin weakly convex, numerous setae scattered over surface, length 0.495 mm., greatest depth distal to the center and equal to 0.155 mm.; metatarsus subcylindrical, proximal end with slightly greater depth than distal end, margins nearly straight, tactile seta of extensor surface within less than one-tenth of the length of the metatarsus from the proximal end; length of metatarsus 0.25 mm., depth 0.095 mm.; telotarsus with virtually straight flexor margin, extensor margin convex, length 0.187 mm., greatest depth 0.068 mm. near the midpoint of the podomere; numerous long setae on tarsal podomeres; terminal claws and arolium as in the first leg.

Genital complex: A well-developed pair of lateral cribiform plates present as well as a pair of large median plates; in addition a single and smaller median cribiform plate present in the holotype, possibly one of a pair, the mate of which may have been lost in preparing the specimen for study. Posterior operculum with a marginal row of six well-separated setae; anterior operculum with a group of three irregularly arranged setae anterior and to each side of the genital aperture.

TYPE LOCALITY: The female holotype collected by Dr. W. J. Gertsch at Barro Colorado, Canal Zone, on February 10, 1936.

Pachyolpium adiposum is related structurally to several *Pachyolpium* species characterized by stout palpal podomeres: *P. incertum* Beier, 1931, *P. reimoseri* Beier, 1931, and *P. arubense* Beier, 1936. Separation of *P. adiposum* from *P. incertum* may be made by the larger size of the body in the former, the greater length of the movable chelal finger, and the shape of the palpal femur. From *P. arubense* and *P. reimoseri*, our form may be distinguished by the movable chelal finger which is longer than the hand without the pedicle, by differences in the shape of some of the palpal podomeres, and by a stouter palpal femur.

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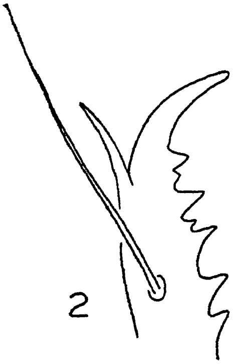

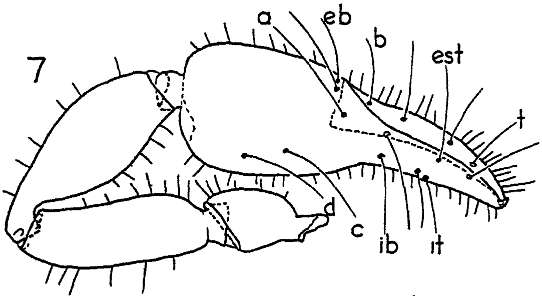

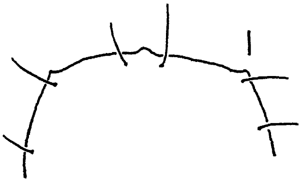

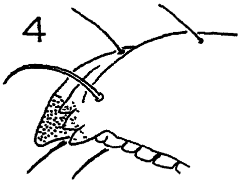

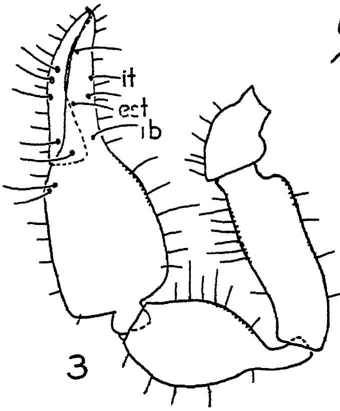

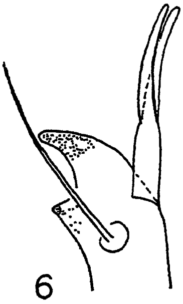

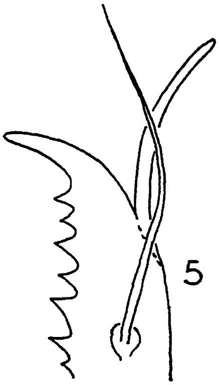

Fig. 1. *Pachychitra insularum*, new species, dorsal view of anterior end of carapace, male paratype; not treated with KOH solution.

Fig. 2. Idem, end of movable finger of chelicera, male holotype; serrula exterior omitted.

Fig. 3. Idem, dorsal view of palp of male paratype; lettering as in the text.

Fig. 4. Idem, receptor venedentis and distal end of movable finger of chela, male paratype.

Fig. 5. Idem, end of movable finger of chelicera, female allotype; serrula exterior omitted.

Fig. 6. *Menthus mexicanus*, new species, end of movable finger of chelicera, female holotype; serrula exterior omitted.

Fig. 7. Idem, dorsal view of palp, female holotype; lettering as in the text.

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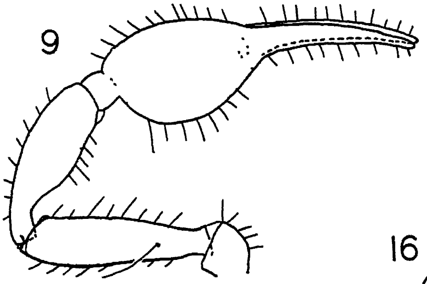

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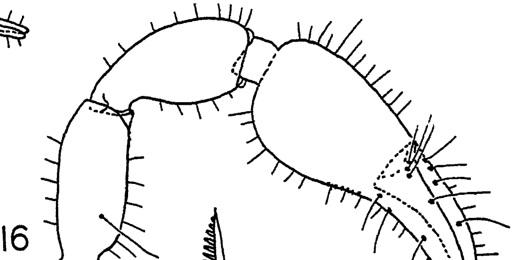

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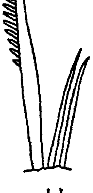

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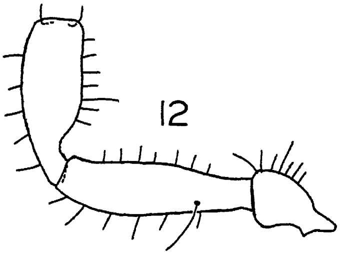

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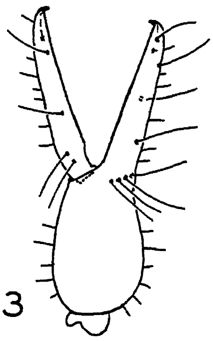

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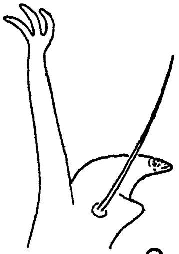

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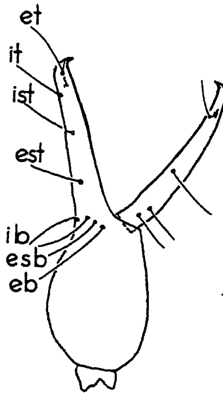

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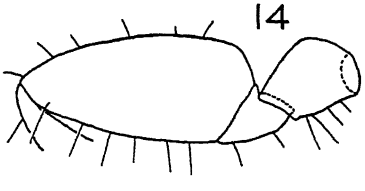

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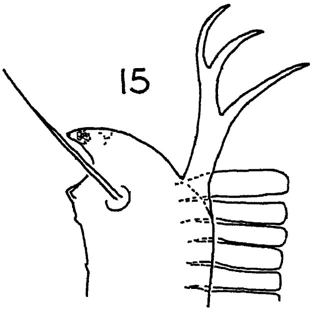

Fig. 8. *Apolpium ecuadorensis*, new species, end of movable finger of chelicera, female holotype; serrula exterior omitted.
Fig. 9. Idem, dorsal view of palp, female holotype; tactile setae of chelal fingers omitted.
Fig. 10. Idem, lateral view of chela, female holotype; setae except tactile ones omitted; lettering as in the text.
Fig. 11. *Apolpium parvum*, new species, flagellum of chelicera, female holotype.
Fig. 12. Idem, dorsal view of distal podomeres of palp, female holotype.
Fig. 13. Idem, lateral view of chela, female holotype.
Fig. 14. Idem, trochanter and femur of fourth leg, female holotype.
Fig. 15. *Pachyolpium adiposum*, new species, end of movable cheliceral finger, female holotype.
Fig. 16. Idem, dorsal view of palp, female holotype.

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REMARKS ON SOME CHESTER PENTREMITES

BY OTTO HAAS

A fossil collecting trip to Crane, Indiana, in October, 1944, yielded a rich collection of bryozoans, brachiopods, blastoids, corals, crinoids, gastropods, echinoid spines, and trilobites (here approximately listed in order of abundance), a few *Spirorbis*, and a single pelecypod from the Glen Dean limestone (uppermost Middle Chester, Mississippian). Only the blastoids, all of which are referable to the genus *Pentremites* Say, are dealt with in this article. It is intended to publish some observations on the genus *Archimedes* and an annotated faunal list in the near future.

In addition to the specimens collected by the writer, some previously present in the collections of the American Museum of Natural History have been included in the present study, as well as a collection sent to this museum for study and identification by Lieut. William N. Dale, U.S.N., of Crane, Indiana. Our thanks are due to Lieutenant Dale for permission to keep some specimens of particular scientific interest for the museum collections and for calling my attention to the hitherto unexploited fossil localities, all of which are within the area of the Naval Ammunition Depot, Crane, Indiana, and for most helpful support of my work there.

The following 10 forms of *Pentremites*, totaling about 280 specimens, can be recognized:

Pentremites spicatus Ulrich, *sensu lato*

Altogether about 70 specimens, plus numerous fragments

Figures 1–13

Long before the creation of this species by Ulrich (1917, p. 263, pl. 7, figs. 33–35) it was, according to S. Weller (1920, pp. 371, 372; see also Wood, 1909, p. 16, pl. 3, figs. 14–16), named *P. cherokeus* by Troost (1850, p. 60). This name, however, was a *nomen nudum*, used some years later by Hall (1858, p. 691, pl. 25, fig. 12) for a somewhat different form. Later, the blastoids belonging to *P. spicatus* were usually, though wrongly, referred to *P. sulcatus* Roemer (1851, p. 355, pl. 6, fig. 10, pl. 4, figs. 5, 6, pl. 5, fig. 7) which, however, lacks, even at a considerable size, the sharp spikes characteristic of the present species and has a broader base.

When establishing this species, which may be considered one of the best index fossils of the Glen Dean horizon and which certainly is the most spectacular, Ulrich (*loc. cit.*) stated that "the available material of *P. spicatus*. . .is divisible into three or four varieties differing from each other in the relative height of the pelvis, in the shape of the calyx, and in minor details of the structure." However, Ulrich illustrated just one individual, which thus became the holotype of the typical *P. spicatus*, without depicting, defining, or naming any of the other forms distinguishable within this species; at least two of them, however, seem so clearly distinct from the typical one as to deserve varietal names.

Within the present material the following forms of *P. spicatus, sensu lato,* are recognized:

(A) forma typica

About 45 specimens

Figure 8

This form is characterized, within the scope of this species, by the fact that the greatest transverse diameter of the calyx about equals, or even exceeds, its height, measured from the columnar facet to the very tips of the deltoids; accordingly, the calyx tapers rather quickly toward the summit. In addition to Ulrich's holotype

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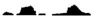

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the two specimens simultaneously illustrated by Butts (1917, p. 100, pl. 24, figs. 3, 4), all the individuals of the fine ontogenetic series shown by Hambach (1903, pl. 6) under the name *P. sulcatus* (with the exception of the one represented in fig. 8 of that plate), and the calyx figured under the same name by Rowley (1903, pl. 36, fig. 4) appear to be referable to this typical form, as does Troost's type of his "*P. cherokeus*" illustrated only in 1909 by Wood (pl. 3, figs. 14–16). A specimen from Crane, with three sharp spikes out of five well preserved, is believed to be particularly characteristic of this form and is, therefore, shown in figure 8.

(B) Var. **porrecta,** new variety

22 specimens

Figures 1, 2, 5, 7, 9, 10

The height of the calyx, measured as above, decidedly exceeds its greatest transverse diameter; accordingly, the calyx tapers more gently in this form than in the typical one. Among several fine specimens the largest one, matching Ulrich's holotype of this species in width and even exceeding it in height, is designated the holotype of this variety (figs. 2, 5, 7). Two paratypes from the same locality, one representing an earlier ontogenetic stage, the other remarkable for being particularly slender, are shown in figures 10 and 1, respectively.

Of previously figured individuals those shown in Hambach's (1903, pl. 6) figure 8 and S. Weller's (1920, pl. 10) figure 8 (reproduced by J. M. Weller, 1931, pl. 44, fig. 3) are believed to belong to this variety.

Furthermore, a spectacular specimen from the Chester group (probably Glen Dean formation also) of "6 mi. from Shoals, Martin County,[1] Indiana," in the collections of the American Museum of Natural History, measuring 45 mm. in height and 36 mm. in width, originally determined as *P. basilaris* Hambach,[2] is referred to this variety instead, although it slightly differs from its holotype by having less-developed deltoidal spikes and less prominent ridges bordering the ambulacra. This specimen is shown in figure 9.

(C) Var. **altipelvis,** new variety

4 specimens

Figures 3, 4, 6, 11–13

As pointed out by Ulrich (*loc. cit.*), there is considerable variation as to the relative height of the pelvis in *P. spicatus;* this holds true for the typical form as well as for the variety *porrecta.* However, a third, though less abundant, form can readily be distinguished from the two preceding ones by the height of its pelvis which attains a third of the total height of the

Figs. 1–13. *Pentremites spicatus* Ulrich, *sensu lato.*

Fig. 8. *Forma typica;* hypotype, A.M.N.H. No. 26057/5:1; quarry "IIc."

Figs. 1, 2, 5, 7, 9, 10. Var. *porrecta,* new variety. 2, 5, 7, Holotype, A.M.N.H. No. 26058/2: 1; quarry "II"; 2, apical view, 5, side view, 7, basal view. 1, Paratype A.M.N.H. No. 26058/2 : 2; qarrry "II"; side view. 10, Paratype A.M.N.H. No. 26058/2:3; quarry "II"; side view. 9, A somewhat deviating paratype, A.M.N.H. No. 7846/1; side view.

Figs. 3, 4, 6, 11–13. Var. *altipelvis,* new variety. 3,6, Holotype, A.M.N.H. No. 26059; 3, side view, 6, basal view. 4, Paratype A.M.N.H. No. 26059/1:1; quarry "II"; side view. 11–13, Paratype A.M.N.H. No. 26059/2 :1; quarry "IIa"; 11, side view, 12, apical view, 13, basal view.

The specimen shown in figure 9 is from the Chester group (probably Glen Dean), 6 miles from Shoals, Martin County, Indiana. All the others are from the Glen Dean limestone of the vicinity of Crane, Martin County, Indiana. For specimens collected by the writer himself more precise locality data are given by numbers assigned by him to various quarries and other localities in that vicinity.

All figures are natural size.

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[1] The localities near Crane where I collected are in the same county.

[2] This species has, according to Greger (1934, p. 147), never been recorded again since its creation by Hambach (1886, p. 159, pl. B, fig. 9). According to its author it differs from *P.* "*sulcatus*" (= *spicatus*) by having a more horizontal base and, as may be added, broader, less ogival ambulacra, but Rowley (1903, pp. 163, 194) declares it to be a synonym of *Pentremites* "*sulcatus.*"

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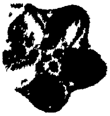
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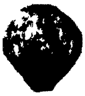
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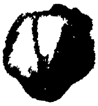
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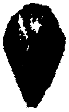
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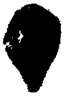
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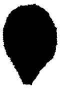
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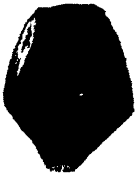
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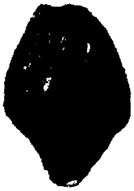
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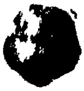
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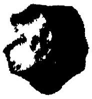
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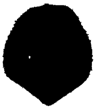
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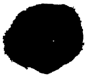
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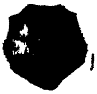
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calyx or even slightly more. The specimen A.M.N.H. No. 26059, collected by Lieutenant Dale, is designated the holotype of this variety (figs. 3, 6). A paratype, representing an earlier ontogenetic stage, is illustrated in figures 11–13; another, of about the same size as the holotype but with an even higher pelvis, in figure 4.

No specimens referable to the variety *altipelvis* could be found in the previous literature.

Pentremites cherokeeus Hall

5 specimens

Figures 14–16

As S. Weller (1920, pp. 371–372) justly emphasizes, this species has to be interpreted solely on the strength of Hall's (1858, p. 691, pl. 25, fig. 11) description and figures. If so, it is found to be distinguished by developing at a comparatively early stage deltoidal spikes and particularly by the tendency of the latter to bend outward, thus producing a slight concavity in the deltoidal edges immediately below them. Except for the last feature and for its smaller size, this species closely resembles *P. spicatus;* it has the width of the calyx in common with the typical form of Ulrich's species, and the relative height of the pelvis with its variety *altipelvis*. From small individuals of the latter variety those of *P. cherokeeus* can be distinguished only if the spikes are well enough preserved to disclose their centrifugal trend. Thus

Figs. 14–16. *P. cherokeeus* Hall. 14, 15, Hypotype, A.M.N.H. No. 26060/1:1; quarry "IIc"; 14, side view (slightly inclined, to show spikes in the rear), 15, apical view. 16, A.M.N.H. No. 26060/1:2; quarry "IIc"; side view; note serrate left margin.

Figs. 17–19. *P. elegans* Lyon. 17, Smallest specimen present, A.M.N.H. No. 26061/1:1; quarry "IIc"; side view, × $^3/_2$. 18, A.M.N.H. No. 26061:1; quarry "IIa"; apical view. 19, Hypotype, A.M.N.H. No. 26061/1:2; quarry "IIc"; side view.

Figs. 20–22. *P. okawensis* S. Weller. 20, A specimen with particularly high pelvis, A.M.N.H. No. 26063/2:1; locality "III"; side view. 21, Hypotype, A.M.N.H. No. 26063/1:1; quarry "IIa"; side view. 22, A small specimen, A.M.N.H. No. 26063:1; quarry "II"; side view, × $^3/_2$.

Figs. 23–26, 28. *P. pyramidatus* Ulrich. 23, Hypotype, A.M.N.H. No. 26062/2:2; quarry "IIc"; side view. 24, A medium-sized specimen with stalk, A.M.N.H. No. 26062/3:2; locality "III"; side view. 25, A small specimen with comparatively short ambulacra, A.M.N.H. No. 26062/3:1; locality "III"; side view. 26, Largest specimen present, A.M.N.H. No. 26062/2:1; quarry "IIc"; side view. 28, Another medium-sized specimen, A.M.N.H. No. 26062/1:1; quarry "II"; side view.

Figs. 29–31, 35. *P. lyoni* Ulrich, *forma typica*. 29, Hypotype (closely resembling the holotype), A.M.N.H. No. 26064; side view. 30, An unusually large, crushed individual, A.M.N.H. No 26064/1:2; quarry "I"; side view. 31, A specimen closely resembling Ulrich's (1917, pl. 7) figure 29, A.M.N.H. No. 26064/3:1; quarry "II"; side view. 35, A specimen closely resembling Ulrich's (1917, pl. 7) figure 28, A.M.N.H. No. 26064/1:1; quarry "I"; side view.

Figs. 27, 36, 37. *P. lyoni* Ulrich, var. *gracilens* Ulrich. 27, A small specimen, closely resembling Ulrich's (1917, pl. 7) figure 31, A.M.N.H. No. 26065/3; quarry "IIc"; side view. 36, A specimen closely resembling Ulrich's (1917, pl. 7) figure 32, A.M.N.H. No. 26065:1; side view. 37, Hypotype (nearly as slender as, and markedly larger than, the holotype), A.M.N.H. No. 26065:2; side view.

Figs. 32, 34, 39, 40. *P. brevis* Ulrich. 32, 34, 39, Hypotype, A.M.N.H. No. 26068:1; 32, apical view, 34, side view, 39, basal view. 40, Basal view of a small calyx, A.M.N.H. No. 26068:2, × $^3/_2$.

Fig. 41. *P.* cf. *brevis* Ulrich. A.M.N.H. No. 26069; quarry "I"; side view.

Figs. 33, 38, 42. *P. hambachi* Butts ? A.M.N.H. No. 26070; 33, apical view, 38, side view, 42 basal view.

All specimens are from the Glen Dean limestone of the vicinity of Crane, Martin County, Indiana. For specimens collected by the writer himself more precise locality data are given by numbers assigned by him to various quarries and other localities in that vicinity.

Unless otherwise indicated, the figures are natural size.

the question may well be raised whether *P. cherokeeus* should not better be relegated to the rank of another variety of *P. spicatus*.[1]

A comparatively well-preserved specimen of *P. cherokeeus* from Crane is shown in figures 14 and 15, a less well-preserved one in figure 16, the latter for exhibiting the same "crimped" sharp edge as the individual figured by Rowley (1903, p. 116, pl. 36, fig. 6). It might be added that the latter feature occurs, as previously stated by S. Weller (1920, p. 368, "serrate margin [of] the plates"),[2] sometimes in *P. spicatus* as well, e.g., in the holotypes of both the typical form and the new variety *porrecta*. This fact further supports the above assumed close relationship of *P. spicatus* and *P. cherokeeus*.

Pentremites elegans Lyon

13 specimens, 5 only doubtfully referred to this species

Figures 17–19

This species, judged as it has to be by Lyon's (1860, p. 632, pl. 20, fig. 4) original description and figures, appears to be distinguished by having the greatest diameter of the calyx somewhat below the middle of its height, by the neatly concave interambulacral areas, each consisting of two even planes which meet at the clearly marked median suture at a pronounced though obtuse angle, and by the shortness of the deltoids which do not reach the face of the summit even in the holotype, much less so in smaller individuals, and which cling to the curvature of the calyx.[3]

Especially if viewed apically, some of our specimens referred to this species are rather similar to *P. canalis* Ulrich (1917, p. 262, pl. 7, figs. 23–26; Butts, 1917, p. 100, pl. 24, fig. 7) which differs, however, from *P. elegans* by having flat ambulacra, hardly concave interambulacral areas, and "the distinct narrow canal-like furrow at the bottom of the ambulacral area" (Butts, *loc. cit.*). Another Glen Dean species resembling *P. elegans* in certain characters is *P. hambachi* Butts (1926, p. 198, pl. 65, fig. 2), but it is readily distinguished by its more globose shape, its shorter pelvis, and its considerably longer ambulacra which descend markedly below the maximum width of the calyx.

The smallest specimen present and a medium-sized one are shown in side views in figures 17 and 19, respectively; in addition, the apical view of a small calyx is given in figure 18.

Pentremites pyramidatus Ulrich

About 25 specimens, one with stalk preserved

Figures 23–26, 28

This species of Ulrich's (1905, p. 64, pl. 7, figs. 12–14; see also Butts, 1917, p. 99, pl. 24, fig. 1) is characterized by the gentle convexity of the outlines of the upper part of the calyx on the one hand and by the clearly pyramidal shape of its lower part, which is surrounded by five plain faces, on the other. The upper parts of the radials and the deltoids, though slightly convex in the vertical sense, are flat, not concave, transversely. The ambulacral areas are not, or only very slightly, depressed, except for the pronounced median furrow which is rather deep in some specimens.

Only two of these distinctive characters, however, serve to separate this species from the contemporaneous, closely related *P. lyoni* Ulrich (see below). S. Weller (1920, p. 326) believes that the latter "differs from *P. pyramidatus* chiefly by reason of its gently concave interambulacra." This is, however, only one of two differences prevailing between these two species. There is still another, which proves, in my opinion, no less helpful. The lower ends of the ambulacra are marked in both species by sharp, vertically elongated projections, which may be even more pronounced in some individuals of *P. lyoni* than they are generally in *P. pyramidatus*. However, while these prominences tend to vanish farther down the pelvis in the former species, they continue as distinct though sometimes blunt edges toward the columnar facet in the latter. Curiously, this difference can be tested even better by touch than by sight; if the basis is spun between two fingers, the edges are well felt in *P. pyramidatus*, but not in *P. lyoni*. It must be admitted that the specimens figured by S. Weller (1920, pl. 4, figs. 21–29)[1] under the name of *P. pyramidatus* do not exhibit the distinct edges here thought to be characteristic of this species, but it must be kept in mind that they are from the Paint Creek formation, whereas the true *P. pyramidatus* Ulrich is a "Birdsville," more specifically a Glen Dean, form (see Ulrich, 1905, p. 64; Ulrich, 1917, pp. 185, 220, 226; Butts, 1917, pp. 98, 99; Butts, 1926, p. 198). Thus the conspecificity of Weller's Paint Creek specimens cannot be considered to be beyond any doubt.

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[1] This would, at least approximately, restore the original taxonomic situation, since Hall believed his form to be conspecific with Troost's which much later turned out to belong to *P. spicatus*. On the other hand, the inclusion by Hall (1858, p. 691) of *P. sulcatus* Roemer in the synonymy of *P. cherokeeus* can, for the reasons stated above, certainly not be maintained.

[2] An extreme development of this feature is found in *P. serratus* Hambach (1903, p. 56, pl. 4, fig. 9; Butts, 1917, p. 116, pl. 28, figs. 10, 11) which Rowley (1903, p. 163), however, considers to be merely "an extravagant form of *P. sulcatus*."

[3] Whitfield's (1891, p. 577, pl. 13, fig. 4 = 1893, p. 466, pl. 9, fig. 4) Ohio specimen, refigured by Morse (1914, p. 360, fig. 2), might represent a slender variety of *P. elegans*. Troost's *P. tennesseeae* (*nomen nudum;* see Wood, 1909, p. 14, pl. 2, figs. 10–12) is certainly not conspecific with Lyon's species; it seems to be much closer to *P. pyramidatus* Ulrich (see below).

A specimen of about the same size as that illustrated by Butts (1917, pl. 24, fig. 1), but somewhat higher and more slender and with shorter ambulacra, is shown in figure 26. Considering its close similarity with that specimen of Butts (whose identification may be assumed to have met with Ulrich's approval), it is left with this species despite the fact that its pelvis is higher than in Ulrich's (1905) types. Two small specimens, one of which is shown in figure 25, also exhibit comparatively short ambulacra. Three medium-sized individuals, believed to be typical of this species, are illustrated in figures 23, 24, and 28.

Pentremites okawensis S. Weller

12 specimens

Figures 20–22

This species (Weller, 1920, p. 357, pl. 10, figs. 5[2]–7; Butts, 1926, p. 198, pl. 65, fig. 4) is somewhat reminiscent of, and probably closely related to, *P. pyramidatus*, but is clearly distinguishable from it by the extraordinary height of the dorsal region, which occupies from about three-fifths to about two-thirds of the total height of the calyx; the former ratio is found in S. Weller's types, the latter in Butts' specimen from Alabama as well as in most of those in the present material. The ambulacra do not extend beyond the greatest width of the body. They are, therefore, short and appear shorter and broader, the higher the pelvis. This makes our specimens look somewhat different from S. Weller's types, though very much like Butts' form. An individual with particularly high pelvis is shown in figure 20; another, which is only slightly stouter, in figure 21, and a small one, whose dorsal part attains only about three-fifths of the total height, in figure 22.

Pentremites lyoni Ulrich, *sensu lato*

Altogether about 95 specimens

Figures 27, 29–31, 35–37

This species of Ulrich's (1917, pp. 262, 263, pl. 7, figs. 27–32) is represented in the material examined by the largest number of individuals. As indicated by S. Weller (1920, p. 326), this species is pretty close to *P. pyramidatus* Ulrich; for ways and means of distinguishing them all the same reference is made to the above discussion of the latter species (p. 6).

Both forms distinguished by Ulrich (*loc. cit.*) within this species are present:

(A) **forma typica**

About 50 specimens, one with stalk preserved

Figures 29–31, 35

The variations studied by Ulrich in this, the stouter form of *P. lyoni*, are recognizable in the material from Crane as well. Some individuals, e.g., the hypotype shown in figure 29, most closely resemble the holotype (Ulrich, 1917, pl. 7, fig. 27); others, e.g., the specimen illustrated in figure 35, Ulrich's (*op. cit.*) figure 28, still others, of which figure 31 shows a good example, his figure 29. In addition, there are five specimens present which, measuring up to 45 mm. in height, by far exceed in size all those figured by Ulrich. All are, however, badly crushed, and it cannot be determined with any degree of certainty how far the deep concavity of some of their interambulacral areas is due merely to crushing. Be that as it may, they agree in all other characters, so well with *P. lyoni* that they, too, are referred to this species. The largest of these calyces is shown in figure 30.

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[1] Figures 23 and 24 are reproduced by J. M. Weller (1931, pl. 41, figs. 12, b, a).

[2] Reproduced by J. M. Weller, 1931, pl. 42, fig. 8.

(B) Var. **gracilens** Ulrich

About 45 specimens, one with stalk preserved

Figures 27, 36, 37

This variety, deviating from the typical form by being more slender, but displaying, like the former, considerable variation within itself, is also well represented at Crane. Most of the variants distinguished by Ulrich in his material can also be recognized here. The small individual illustrated in figure 27 is reminiscent of Ulrich's (1917, pl. 7) figure 31; the fine specimen shown in figure 36, of his figure 32. There is, however, none so slender as Ulrich's holotype (*op. cit.*, fig. 30); the individual illustrated in figure 37 (hypotype) comes closest to it in slenderness. It is markedly larger than the holotype, but it is still exceeded in size by a much less well-preserved specimen from quarry "II" which, when complete, must have measured at least 35 mm. in height.

Pentremites brevis Ulrich

8 specimens

Figures 32, 34, 39–41

This species, established but neither described nor figured by Ulrich in 1917 (p. 226), was first illustrated by Butts (1917, p. 100, pl. 24, fig. 6), but more thoroughly studied and discussed only by S. Weller (1920, p. 369, pl. 4, figs. 43–46). This author also described the differences between this species and his closely related, somewhat older *P. platybasis* (1920, p. 355, pl. 4, figs. 37–42).

A small but perfectly preserved calyx from Crane, closely resembling those figured by Weller (*loc. cit.*) as well as the one illustrated by Butts (1926, p. 198, pl. 65, fig. 3) from the Bangor limestone of Alabama, is shown in figures 32, 34, and 39 in apical, lateral, and basal views. The stem facet is seen even more clearly in the basal view (fig. 40) of an even smaller calyx. Two individuals from Crane, one of which (base incomplete) is shown in figure 41, seem to be unusually depressed and markedly wider than all previously figured individuals of this species; they are too poorly preserved to warrant separation of a variety, and are merely labeled *P.* cf. *brevis* Ulrich.

ADDENDUM

Pentremites hambachi Butts?

1 specimen

Figures 33, 38, 42

After completion of the above report three more excellently preserved specimens of *Pentremites* were received from Lieutenant Dale. One of them cannot well be placed with any of the forms from Crane hitherto listed in the present paper. It approaches most closely our specimens referred to *P. elegans* (p. 6, figs. 17–19), but its interambulacral areas are not so pronouncedly concave, and its ambulacra are somewhat narrower and, except for the median furrow, not deepened. Furthermore, the pelvis is much shorter in this specimen than in either *P. elegans* or *P. canalis*, and its ventral region is more curved than in the latter species. All these differences make for a close similarity of this calyx with the holotype and only figured specimen of *P. hambachi* Butts (1926, p. 198, pl. 65, fig. 2). However, it differs from the latter by the fact that the ambulacra, though fairly long, do not reach beyond the maximum width of the calyx, as they do in the holotype. Although this difference may be due to ontogenetic reasons only, the present specimen is only doubtfully referred to Butts' species. It is remarkable for neatly showing, in basal view (fig. 42), all the boundary lines of the three basal plates.

This individual increases the number of *Pentremites* forms in the material from Crane from 10 to 11.

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NEW SPIDERS IN THE GROUP DIONYCHA WITH NOTES ON OTHER SPECIES

By B. J. Kaston[1]

In the course of my studies of the spider fauna of Connecticut a number of new species were encountered. It was originally planned to describe them in a large monograph, the manuscript of which was completed for the Geological and Natural History Survey about four years ago. Since, however, its publication will be still further delayed, it is thought advisable to publish, in a series of short papers, the descriptions of new species, together with discussions of synonymy and various other taxonomic matters in other species. This first paper is concerned with the dionychous families Gnaphosidae, Clubionidae, Thomisidae, and Salticidae.

The types of the new species here described are deposited in the collection of the American Museum of Natural History. I wish to thank Dr. W. J. Gertsch for allowing access to this and much other material for comparison. Thanks are likewise due Miss E. B. Bryant for kind advice and for the loan of material from the Museum of Comparative Zoölogy, and my wife, who prepared all the illustrations.

Gnaphosidae

Drassodes auriculoides Barrows

Figures 1, 2

Drassodes auriculoides Barrows, 1919, Ohio Jour. Sci., vol. 19, p. 355, pl. 15, figs. 4a–4b, ♀.

Drassodes robinsoni Kaston, 1938, Bull. Brooklyn Ent. Soc., vol. 33, p. 178 (for the most part), pl. 8, figs. 12–14, ♀ (not *robinsoni* Chamberlin).

Not *Geodrassus auriculoides* Kaston, 1938, *ibid.*, vol. 33, p. 175.

In 1922 Chamberlin placed this species in his newly erected genus *Geodrassus.* Since the appearance of my 1938 paper I have had an opportunity to study the type, through the kindness of Dr. Barrows, and can definitely state that Chamberlin was in error. As in other *Drassodes,* this species has two retromarginal cheliceral teeth, not one.

Drassodes robinsoni Chamberlin

Figure 3

Drassodes robinsoni Chamberlin, 1919, Ann. Ent. Soc. Amer., vol. 12, p. 245, pl. 16, fig. 2, ♀; Kaston, 1938, Bull. Brooklyn Ent. Soc., vol. 33, p. 179 (in part, none of the figures).

This species very closely resembles *auriculoides.* The segments of the male pedipalp have the proportions as in *neglectus* Keyserling (fig. 4), but the tibial apophysis is more slender, like that of *auriculoides* (fig. 2). The epigynum more nearly resembles the latter species, but the comments published by me in 1938 concerning the Woods Hole, Massachusetts, specimens, refer to this species and not to *auriculoides,* to which all the other specimens belonged.

Geodrassus gosiutus (Chamberlin)

Figure 5

Drassodes gosiutus Chamberlin, 1919, Ann. Ent. Soc. Amer., vol. 12, p. 245, pl. 16, fig. 3, ♂.

Geodrassus auriculoides Kaston, 1938, Bull. Brooklyn Ent. Soc., vol. 33, p. 175, pl. 8, figs. 5–8, ♀♂; Kaston, 1938, Bull. Connecticut Geol. Nat Hist. Surv., no. 60, p. 192 (not *Drassodes auriculoides* Barrows).

Zelotes inheritus, new species

Figures 6, 7, 42

Male: Total length, 8 mm. Carapace, 3.54 mm. long, 2.68 mm. wide. Abdomen, 4 mm. long, 2.35 mm. wide.

Coloration and general appearance as in *subterraneus,* with carapace, chelicerae, maxillae, sternum, and legs dark chestnut brown irregularly streaked with much black. Abdomen above dark gray, except for the scutum which is chestnut brown like the carapace. Venter gray.

---

[1] Brenau College, Gainesville, Georgia.

Eyes typical with the posterior row straight and wider than the anterior (36/30), the posterior medians oval, slightly smaller than the laterals, and the median ocular area slightly wider behind than in front (16/15). Carapace widest between coxae II and III, narrowing at clypeus to slightly less than half that (40/17). Chelicerae with four teeth on the promargin and two on the retromargin of the fang furrow. Labium longer than wide. Sternum oval, longer than wide.

Legs 4123. Tarsus I and II and distal two-thirds of metatarsus I and II scopulate beneath. Tarsus III and IV setose ventrally. Tibia and metatarsus I and II unspined. Abdomen with a scutum as wide at base as the dorsum, extending 25/60 the length of, and gradually narrowing at its posterior end to, half the width of the dorsum.

Palpus of the same general type as in *pullus*, *subterraneus*, and related species, with a fine curved embolus and two leaf-like processes at the distal end of the bulb. The tibial apophysis extends half the length of the cymbium, longer than in *subterraneus*, and not so thin as in *pullus*.

FEMALE: Total length, 9 mm. Carapace, 2.9 mm. long, 2.22 mm. wide between coxae II and III; narrowed to just half that at the clypeus. Abdomen, 6 mm. long, 3.16 mm. wide.

Similar to male in general appearance and structure. Abdomen lacking a scutum, and evenly gray throughout except for a median longitudinal lighter gray band on venter the width of the epigynum and extending back not quite to spinnerets. The epigynum has a distinct pigmented ridge between the two anterior rounded corners, and the distance between these is less than that between the openings in front of the receptacula; much less than is the case in *pullatus* Fox, *subterraneus* (Koch), and related species.

TYPE LOCALITY: Male holotype from Mt. Carmel, Connecticut, April 19, 1935 (B. J. Kaston). Female allotype from Keene Valley, Essex County, New York, June 27, 1917 (Howard Notman). Two male paratypes from Crow Hill, Onondaga County, New York, August 13 (Britcher).

Zelotes pullus (Bryant)

Drassyllus pullus BRYANT, 1936, Psyche, vol. 43, p. 95, pl. 3, figs. 4–5, ♂ (not *pullatus* Fox 1938).

This species is quite close to *inheritus* in structure of the palpus, and is a true *Zelotes*.

Zelotes duplex Chamberlin

Zelotes duplex CHAMBERLIN, 1922, Proc. Biol. Soc. Washington, vol. 35, p. 164, ♀.

Zelotes sylvanus CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 176, figs. 202–203, ♀ ♂.

Sergiolus decoratus, new species

Figures 8, 17–19

MALE: Total length, 4.7 mm. Carapace 2 mm. long, 1.4 mm. wide. Abdomen, 2.7 mm. long, 1.2 mm. wide.

Carapace orange throughout, with the somewhat darker dorsal furrow faintly indicated. Chelicerae and maxillae darker orange, but sternum and coxae yellow. Legs orange with gray to black areas on distal half of femora I and II, patellae I and II, and proximal ends of tibiae I and II; black on distal ends of femur, tibia, and metatarsus IV. Abdomen dark gray above with white transverse bands as follows: one close to the anterior end, one about halfway back, and a third near the posterior end. The latter is broken in the middle. Extending forward from the middle band is a faintly indicated T-shaped mark with the horizontal portion of the "T" extending toward the sides so that a fourth band appears to be present between the first and second. Venter light gray.

Eye relations typical. Retromargin of cheliceral fang furrow without teeth. Dorsum with a conspicuous shiny scutum extending back almost two-thirds the length of abdomen, to as far beyond the middle white band as the thickness of the band itself.

Palpus as figured. The tibial apophysis is broad, notched at the tip, and lies against a concavity on the side of the cymbium.

FEMALE: Total length, 6.7 mm. Carapace 3 mm. long, 2 mm. wide. Abdomen. 3.7 mm. long, 2.3 mm. wide.

Agreeing in general with the male. The abdomen is darker beneath and has the dorsal T-shaped mark more conspicuous, as in *variegatus*. The epigynum shows a pair of large receptacles through the skin; near the posterior end is a broadly oval fossa with a heavily sclerotized pigmented rim. The openings are tiny and lie on either side of the center of the posterior rim.

TYPE LOCALITY: Male holotype and female allotype from Woods Hole, Massachusetts, July 6, 1901 (Britcher). A male paratype from Waubay, South Dakota, June 22, 1936 (Peterson); another male paratype from near Chicago, Illinois, June; a female paratype from Cold Spring Harbor, New York, August 1, 1902 (Emerton). These paratypes are all somewhat smaller than the types. In the Museum of Comparative Zoölogy is a female (labeled *decipiens*) from Menemsha, Martha's Vineyard, Massachusetts, July 21, 1925 (G. H. Parker). It is a well-marked individual and slightly larger than the allotype. I also have a young specimen from Moorestown, New Jersey.

This species resembles *segregatus* Chamberlin, *variegatus* (Hentz), and *decipiens* Chamberlin. From *variegatus* it differs in that neither the posterior declivity of the carapace nor the proximal end of tibia IV is black and in that the abdominal markings do not show the posterior band so far back or so distinct. In males the central T-shaped spot is not so distinct, the dorsal scutum is larger, and the tibial apophysis is much broader apically. In females the epigynum has the fossa more oval, not so broad, with the anterior pigmented rim more pronounced in the median line and the posterior rim far less developed than in *variegatus*.

In *decipiens* and in *segregatus* the epigynum is much as it is in this species, but in them the openings are farther back in the fossa. Moreover, in these the posterior abdominal band is lacking, or almost so. While in *segregatus* the legs are marked as in *decoratus*, in *decipiens* the black markings are lacking. In both *segregatus* and *decipiens* the tibial apophysis is elongate.

Sergiolus variegatus (Hentz)

Figures 9, 14–16

Herpyllus variegatus HENTZ, 1847, Jour. Boston Soc. Nat. Hist., vol. 5, p. 458, pl. 24, fig. 12, ♀.

Poecilochroa variegata EMERTON, 1890, Trans. Connecticut Acad. Sci., vol. 8, p. 174, pl. 4, figs. 1–1d, ♀ ♂.

Sergiolus capulatus CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 174.

New figures are given of this best known of our species of the genus. It can be distinguished from both *decoratus* and *decipiens* by the presence on the posterior declivity of the carapace of black pigment, as well as fine black hairs, and by a black ring at the proximal end of tibia IV. The tibial apophysis is drawn out to a point which is bent toward the cymbium. The epigynum has the fossa a more transverse short oval with a sclerotized rim that is quite pronounced at the sides and behind, but almost disappears at the middle of the anterior border. The dorsal scutum is just a little over half the length of the abdomen, extending only to the middle, or to the posterior edge, of the second white band.

Sergiolus decipiens Chamberlin

Figure 10

Sergiolus decipiens CHAMBERLIN, 1922, Proc. Biol. Soc. Washington, vol. 35, p. 151, ♂; CHAMBERLIN, 1936, Amer. Mus. Novitates, no. 841, p. 10, fig. 14, ♂.

Poecilochroa decipiens BRYANT, 1935, Psyche, vol. 42, p. 75, figs. 4, 5, ♀ ♂.

Sergiolus ocellatus CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 175.

The epigynum closely resembles that of *decoratus* but has the openings farther back in the fossa, as in *segregatus*. From the latter two species this can be distinguished also by the lack of black markings on the legs.

Sergiolus unimaculatus Emerton

Figures 11, 25, 26

Sergiolus unimaculatus EMERTON, 1915, Trans. Connecticut Acad. Sci., vol. 20, p. 142, pl. 1, figs. 9–9c, ♂.

Sergiolus clericus CHAMBERLIN, 1922, Proc. Biol. Soc. Washington, vol. 35, p. 153, ♀.

In this species the cephalothorax is more narrowed than usual, and the scutum in the male is quite conspicuous and relatively small. Emerton had referred to the tibial apophysis as sharply pointed and slender, but this refers to its appearance as he figured it, from the dorsal aspect. When seen from the side it is fairly broad, as shown in figure 26.

Besides the type of *unimaculatus* from Lyme, Connecticut, and the type of *clericus* from Washington, D. C. (which exactly matches the male), the Museum of Comparative Zoölogy has a female (labeled *montana*) from Lakehurst, New Jersey, July 3, 1912 (J. H. Emerton). The American Museum of Natural History has a female (labeled *clericus*) from Waycross, Georgia, April 21, 1938.

Sergiolus famulus Chamberlin

Figures 12, 20, 21

Poecilochroa montana EMERTON, 1909, Trans. Connecticut Acad. Sci., vol. 14, p. 217, pl. 9, figs. 4–4b, ♂ (not *montana* Emerton 1890).

Sergiolus famulus CHAMBERLIN, 1922, Proc. Biol. Soc. Washington, vol. 35, p. 152, ♀.

The male described by Emerton as *montana* was erroneously synonymized by Chamberlin under *meretrix*, a species only superficially like *famulus* but with an entirely different tibial apophysis. I have a male from Milford, Connecticut, June, 1936 (R. B. Burrows), which in markings, body proportions, and palpal structure agrees exactly with Emerton's male from Massachusetts. While Emerton correctly described the tibial apophysis as "stouter and more curved at the tip" than in *variegatus*, his drawings unfortunately are made from a view which does not facilitate comparison. New drawings are supplied here. In the collection of the American Museum of Natural History is a female from Woods Hole, Massachusetts, July 19, 1901, and two from Cold Spring Harbor, New York, June 19, 1932.

The pattern of abdominal markings in this species is slightly different from that in *meretrix* as can be seen by a comparison of figures 20 and 22. Both have three transverse white bands, with the second and third partly interrupted in the center. In *famulus* the first and second are connected along the sides, and in *meretrix* the middle and posterior bands are connected. In *famulus* the scutum extends back not quite two-thirds the length of the dorsum, being somewhat smaller than in *meretrix*.

Sergiolus meretrix Chamberlin

Figures 13, 22–24

Sergiolus meretrix CHAMBERLIN, 1922, Proc. Biol. Soc. Washington, vol. 35, p. 153, ♂.

Not *Poecilochroa montana* Emerton, 1909.

As pointed out under *famulus* (see above) Chamberlin had wrongly synonymized Emerton's male from Massachusetts under *meretrix*. The tibial apophysis, truncated distally, is longer and more curved dorsad than in *famulus*. The scutum is longer than in *famulus*, extending back seven-eighths the length of the dorsum. Besides the type male from Raleigh, North Carolina, the Museum of Comparative Zoölogy has a female from Alabama. The epigynum differs from that in most of the other species in being broader than long.

Clubionidae

Clubiona elizabethae, new species

Figure 43

FEMALE: Total length, 8.4 mm. Carapace, 2.6 mm. long, 1.95 mm. wide. Abdomen, 4.3 mm. long, 2.8 mm. wide.

Coloration as in *rileyi* Gertsch and related species; pale yellow for the most part, darker at the anterior end with the eyes ringed in black. Chelicerae, labium, and maxillae light brown. Sternum and legs yellow. Abdomen pale yellow with faintly indicated pinkish chevrons on posterior two-thirds.

Both eye rows virtually straight, the first narrower than the second (30/38), the anterior median eyes separated by a diameter, the posterior median eyes by almost twice a diameter and slightly nearer the posterior lateral eyes. Median ocular area broader behind, the eyes all subequal in size. Chelicerae with five teeth on the promargin of the fang furrow and two on the retromargin.

Legs spined as in *rileyi* Gertsch.

Epigynum as in *rileyi* Gertsch, but with the openings relatively larger, and separated by a broad median lobe as figured.

TYPE LOCALITY: Female holotype from Riverton, Connecticut, June 19, 1935, collected by Elizabeth Kaston.

Agroeca ornata Banks

Agroeca ornata BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 23, pl. 1, figs. 68–68a, ♀.
Rachodrassus monroensis KASTON, 1938, Bull. Brooklyn Ent. Soc., vol. 33, p. 173, pl. 8, figs. 1–4, ♂; KASTON, 1938, Bull. Connecticut Geol. Nat. Hist. Surv., no. 60, p. 193.

The description of *R. monroensis* was based upon a teneral male in which the pigmentation pattern was very faint and the palpal organ unnaturally distended. Moreover, the spinnerets were more widely separated than usual, a condition which has occurred in other members of this genus, so that previous workers likewise have mistaken them for gnaphosids.

Phrurotimpus alarius (Hentz)

Figures 38, 39

Herpyllus alarius HENTZ, 1847, Jour. Boston Soc. Nat. Hist., vol. 5, p. 461, pl. 24, fig. 20, ♀.
Phrurolithus alarius EMERTON, 1890, Trans. Connecticut Acad. Sci., vol. 8, p. 189 (in part), pl. 6, figs. 5a–5g (but not fig. 5 and probably not fig. 5h), ♀ ♂; EMERTON, 1911, *ibid.*, vol. 16, p. 405, pl. 6, figs. 4–4a, ♀ ♂; CHICKERING, 1939, Papers Michigan Acad. Sci., vol. 24, p. 78, figs. 76–79, ♀ ♂.
Phrurolithus palustris BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 23, pl. 1, fig. 70, ♀; BISHOP AND CROSBY, 1926, Jour. Elisha Mitchell Sci. Soc., vol. 41, p. 193, ♀ ♂.
Phrurotimpus palustris CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 188.

This species and the following one, *borealis* Emerton, are variable in degree of pigmentation and, because of their great superficial similarity, have often been mistaken for each other. Bishop and Crosby contended on the basis of markings as shown in the original figure of Hentz that the latter had a specimen of what Emerton in 1911 described as *borealis* and that therefore the species described by Emerton in 1890 under the name of *alarius* Hentz included individuals not really of Hentz's species but new. The species to which Banks in 1892 gave the name *palustris* is the same as what Emerton in 1890 had called *alarius* Hentz, so Bishop and Crosby considered Banks' name as the valid one for the species. I have made an intensive study of the matter, have examined Emerton's and Banks' types as well as other specimens at the Museum of Comparative Zoology and the American Museum of Natural History, and have compared dozens of specimens collected in the South as well as in New England. Included in my collections are, fortunately, pairs *in copula* of both species, enabling me to match the sexes correctly. I conclude that Bishop and Crosby were mistaken, the trouble having come about by Emerton's having confused two species as one in 1890—a confusion which was, however, cleared up by Emerton himself in 1911.

In the first place, in Hentz's figure we have only the pigmentation pattern to go by. While it is true, as observed by Bishop and Crosby, that as far as the cephalothorax and abdomen are concerned the drawing more nearly resembles what Emerton has described as *borealis*, the drawing very plainly shows black spots on legs III and IV. These spots are present only on those individuals, of both sexes, which have in addition all the other characteristics showing them to belong to the one species and not the other. Among these characters are some which Emerton correctly described and figured for what he considered *alarius* Hentz, thus "fixing" the species. These spots are always present in *alarius*. Emerton's figure 5 (and perhaps his fig. 5h) do not belong to *alarius*, but his figures 5b, 5e, 5f, and 5g illustrate characters possessed by individuals with the spotted hind legs, and therefore they must be *alarius*. These characters include: tibia I with five or six pairs of ventral spines, the tibial apophysis of the male palp not abruptly bent at the tip, and the receptacles of the epigynum about half their diameter apart.

In the other species, which must take the name *borealis* Emerton, there are always seven or eight pairs of spines under tibia I (both species have three or four pairs under metatarsus I), the hind legs are not spotted, the tibial apophysis has an oblique truncature near the tip and is bent toward the cymbium, and the epigynum has the receptacles about their diameter apart. Other differences are as follows:

in *borealis* the proximal three-fourths of tibia I is black and provided with a thick ventral brush of hairs in the male, while in *alarius* the brush is absent, the pigmentation is less intense, and in females may be almost completely lacking; the abdomen of *borealis* is darker above, quite iridescent in the male, less so in the female, while in *alarius* it is lighter and only slightly, if at all, iridescent in either sex; the venter of *borealis* is unmarked or at most with two faint longitudinal lines, while in *alarius* there are nearly always two gray spots near the middle.

Both species occur in the same localities, but *borealis* is more common in the northern states and *alarius* in the south. I have myself collected them in Connecticut, Tennessee, and Georgia. In addition, at the American Museum of Natural History there are specimens of *alarius* from New Jersey, Texas, New Mexico, New York, and Washington, D. C., and of *borealis* from Michigan, Utah, Massachusetts, Minnesota, New York, Pennsylvania, Maine, and Texas. At the Museum of Comparative Zoölogy there are specimens of *alarius* from New York, North Carolina, and Florida, and of *borealis* from New Hampshire, Vermont, Massachusetts, and Utah.

Phrurotimpus borealis (Emerton)

Figures 40, 41

Phrurolithus alarius EMERTON, 1890, Trans. Connecticut Acad. Sci., vol. 8, p. 189 (in part), pl. 6, fig. 5 and probably fig. 5h (but not figs. 5a–5g), ♀ ♂; BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 23; COMSTOCK, 1912, Spider book, p. 576, figs. 652–654, ♀ ♂; BISHOP AND CROSBY, 1926, Jour. Elisha Mitchell Sci. Soc., vol. 41, p. 191, ♀ ♂.

Phrurolithus borealis EMERTON, 1911, Trans. Connecticut Acad. Sci., vol. 16, p. 404, pl. 6, figs. 3–3a, ♀ ♂; CHICKERING, 1939, Papers Michigan Acad. Sci., vol. 24, p. 79, figs. 80–82, ♀ ♂.

Phrurolithus utus CHAMBERLIN AND IVIE, 1933, Bull. Univ. Utah, vol. 23, no. 4, biol. ser., vol. 2, no. 2, p. 40, pl. 12, figs. 124–126, ♀ ♂.

Phrurotimpus alarius MUMA, "1943" [1944], Common spiders of Maryland, p. 122, pl. 15, fig. 6, ♀; CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 187.

The characters by means of which this species can be distinguished from *alarius*, with which it has been confused, are discussed under that species, just preceding.

Castianeira[1] gertschi, new species

Figures 27–29

Castianeira aurata EMERTON, 1913, Bull. Amer. Mus. Nat. Hist., vol. 32, p. 258, pl. 48, figs. 8–8b, ♀ ♂; KASTON, 1938, Connecticut Geol. Nat. Hist. Surv. Bull., no. 60, p. 193; CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 180 (not *Herpyllus? auratus* Hentz).

MALE: Total length, 5.2 mm. Carapace, 2.47 mm. long, 1.54 mm. wide, and narrowed to not quite half this much at the clypeus. Abdomen, 2.74 mm. long, 1.27 mm. wide.

The carapace is evenly bright orange with a thin black marginal line, and without pubescence. The legs are about the same color, but with femur I slightly darker, the distal segments yellowish, and with the distal segments of leg IV darker than the femur. The abdomen is orange at the anterior end but increasingly darker toward the rear where it is chestnut brown. There are two transverse bands of white scales, one just behind the middle, one just behind the anterior fourth, and in addition a very faint subbasal band. The two bands are broken in the center so that the effect is as of two white transverse spots each side.

Eyes and other structural characters typical for the genus, with the sternum about four-fifths as wide as long, and with the abdomen, as in the other species, completely covered above by a shiny scutum which, however, does not obscure the pattern.

Palpus as figured, with the embolus short.

FEMALE: Total length, 6.1 mm. Carapace, 3 mm. long, 1.94 mm. wide, and narrowed to just over half this much at the clypeus. Abdomen 3.1 mm. long, 1.8 mm. wide.

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[1] This is the original orthography used by Keyserling in 1879. In 1887 he used this name again but changed the spelling to *Castaneira*, a form followed by many later workers. Petrunkevitch (1939) maintains that this was a correction on the part of Keyserling. But as the latter had plainly stated that *Castianeira* was a *nomen proprium*, there can be no question of an error in transcription, and that it was not a typographical error is indicated by the fact that it appears the same way in the explanation of figures. In his 1887 paper he makes no mention of error or of correction. Hence the change would seem to be no more justified than the attempted changes of other authors, e.g., Hentz's changing *Spermophora* 1841 to *Oophora* in 1850.

Color and structure essentially as in male. However, the scutum is small, the basal white band is lacking so that only two appear, and the metatarsi are darker than in the male.

Epigynum as illustrated in figure 29, with a depressed central area between the openings and posterior to the receptacles.

TYPE LOCALITY: Male holotype from Indian Neck, Connecticut, June 6, 1937 (B. J. Kaston). Female allotype: Watertown, Connecticut, May 30, 1937 (B. J. Kaston). A male paratype from Bethany, Connecticut, June 22, 1938 (D. S. Riggs), and an immature male paratype from Staten Island, New York, January 26, 1912 (J. H. Emerton).

This species is very similar to *trilineata* Hentz. The palpal organ of the latter, however, has a thickened embolic division with two hooked rami; the epigynum of the female has the lips of the openings continued posterolaterally, and the central area is not depressed. Also in this group of species and much more like *trilineata* (if not actually a synonym of it) is *stupkai* Barrows.

It has been assumed by some workers that this (and not a *Micaria*) is the species which Hentz had when he described and figured his *Herpyllus auratus*. Not only was there a difference of opinion as to the generic status of Hentz's species, but the situation had been complicated by the fact that several different spiders had been wrongly synonymized under his name *auratus*. Assuming that what most workers were calling *Micaria aurata* was based on a misidentification, Bryant in 1941 proposed the new name *delicatula* for the *Micaria*.

Hentz's *Herpyllus auratus* was first associated with another genus by Marx, who in his "Catalog" (1890) considered it a *Micaria*. Banks in 1893 placed it in *Thargalia* (= *Castianeira*), but in 1895, in describing *Micaria agilis* as a new species, compared it with *auratus* with which he supposed *agilis* may have been confused. This would indicate that he then considered them congeneric, and Simon in 1897 likewise considered *auratus* a *Micaria*. In 1908 Bryant placed *longipes* Emerton and *formicoides* Banks as synonyms of *auratus* in *Micaria*. But the latter species was again placed in *Castianeira* by Banks in his "Catalog" of 1910, while *longipes*, *formicoides*, and *agilis* were each listed separately under *Micaria*. In 1913 Emerton described a "*Castianeira aurata* Banks (not Hentz)" indicating that he had believed Banks to have made a mistake with respect to the placing of Hentz's species. Emerton had previously (1902) attempted to show that there was a southern *Micaria* which could easily be considered Hentz's *aurata*, and that it differed slightly from the northern *longipes*.

In 1941 Bryant synonymized under *delicatula*, *Micaria aurata* Gertsch, 1933, and *M. aurata* Kaston, 1938. Gertsch had given the name doubtfully to western spiders which he later (1942) considered as new species (*gosiuta* and *alberta*); and while I in 1938 listed them as one I now consider *longipes* as a separate species from *aurata* (see below). In Bryant's discussion of the generic position of *aurata*, reference is made to Hentz's figure showing the characteristic pattern, and she adds "the figure shows the head only slightly narrowed, a character found in *Castianeira* rather than *Micaria* and no indication of an abdominal constriction that is usually found in *Micaria*." If we analyze these data we find, as can be seen from the new figures supplied here, first that the pattern of spots could fit either the *Micaria* or the *Castianeira*. In the second place, the "only slightly narrowed" head quite definitely fits the *Micaria*, where it is 16/25 as wide as the widest part of the carapace, as compared with 11/23 in the *Castianeira*. Third, no value can be attributed to the matter of the abdominal constriction, for this is too variable, and some *Micaria* species do not show it. No such constriction was mentioned or figured by Emerton when he described *laticeps*, *quinquenotata*, and *longispina*, and he definitely stated that *montana* and *gentilis* do not show it. Moreover, while Banks in describing *agilis* refers to the constriction, I have found in his material (from which figs. 33, 34, and

35 were prepared) that there is considerable variation. Moreover, in my own material in *aurata* and *longipes*, specimens which appear gravid do not show the constriction so well. I have also found variation in *multimaculata* (= *laticeps*, see below).

There is one other character, not mentioned by Bryant, but apparent from Hentz's drawing.[1] That is the complete absence of a dorsal thoracic groove. This character is often given in the generic diagnosis of *Micaria*. However, in some specimens the groove is faintly visible, and it has been indicated in drawings made by Emerton for certain species. Nevertheless, the groove is never missing in *Castianeira*, so that on this basis Hentz must have had a *Micaria*.

From all of the foregoing it is apparent that the name *Castianeira aurata* is based upon a misidentification, and must be replaced by the name *C. gertschi* proposed above.

Micaria aurata (Hentz)

Figures 30–35, 44

Herpyllus? auratus HENTZ, 1847, Jour. Boston Soc. Nat. Hist., vol. 5, p. 459, pl. 24, fig. 15, ♂ (not *M. aurata* Canestrini, 1868, or *M. aurata* Gertsch, 1933).

Micaria agilis BANKS, 1895, Ent. News, vol. 6, p. 204.

Micaria aurata EMERTON, 1902, Common spiders, p. 9, fig. 27, ♀.

Micaria delicatula BRYANT, 1941, Psyche, vol. 48, p. 138; CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 185.

This is the southern species, which, however, I have taken in New England at several points along the shore of Long Island Sound. Emerton in 1902 first pointed out that the posterior half of the abdomen in this species is marked with black chevrons. While I have not found this constant, I have noticed that it is more usual, at least in females, while in *longipes* the posterior half of the abdomen either is unmarked or is indistinctly gray to black without chevrons. Moreover, the white spots on the dorsum of this species are thicker than those in *longipes*. By far the best characters, however, are in the genitalia. In males the median apophysis of the bulb in *aurata* is short and stout, while in *longipes* it is long and thin. In the epigynum of females the openings are relatively far apart, and the central narrow canals extend farther forward in *aurata* than is the case in *longipes*.

Banks gave Missouri as the type locality of *agilis*, and included Washington, D. C., and Sea Cliff, New York, as other localities. At the time I was studying his material there were two vials, neither dated, marked "Type," both from Sea Cliff, New York (the Missouri and Washington material having been lost). In one vial there were only juveniles; in the other were a male and four females. Banks used the constriction on the abdomen as a character distinguishing *agilis* from *aurata*, and while the juveniles all show a distinct constriction just in front of the middle of the abdomen, the depth of this constriction varies greatly in the mature females (figs. 33, 34, and 35). As I have tried to point out in the discussion above, the state of gravidity of the females in this, as well as in other, species is presumably a factor altering the depth of the constriction.

Micaria longipes Emerton

Figures 36, 37, 45

Micaria longipes EMERTON, 1890, Trans. Connecticut Acad. Sci., vol. 8, p. 167, pl. 3, figs. 1–1h, ♀ ♂; EMERTON, 1909, *ibid.*, vol. 14, pl. 10, figs. 2–2a, ♂; COMSTOCK, 1912, Spider book, p. 580.

Micaria formicoides BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 14, pl. 1, fig. 51, ♀.

This is the northern species, so often synonymized under *aurata*. I have given the distinguishing characters under the latter (see above).

Micaria laticeps Emerton

Micaria laticeps EMERTON, 1909, Trans. Connecticut Acad. Sci., vol. 14, p. 214, pl. 10, figs. 4–4c, ♂.

Micaria multimaculata KASTON, 1938, Bull. Brooklyn Ent. Soc., vol. 33, p. 182, pl. 9, figs. 18–23, ♀ ♂; KASTON, 1938, Bull. Connecticut Geol. Nat. Hist. Surv., no. 60, p. 194.

Additional study of the types of *multimaculata* and *laticeps* has recently led me to consider them synonymous. Emerton not only failed to see the tibial apophysis, but his description and figure exaggerate the width of the pars cephalica, and his specimen had lost all trace of markings, hence when *multimaculata* was described I considered it distinct from *laticeps.*

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[1] I am indebted to the officials at the New England Museum of Natural History for allowing me to study Hentz's original colored drawings.

Thomisidae

Philodromus placidus Banks

Philodromus placidus BANKS, 1892 (before April), Proc. Acad. Nat. Sci. Philadelphia, p. 62, pl. 3, figs. 25–25a, ♀.

Philodromus bidentatus EMERTON, 1892 (April), Trans. Connecticut Acad. Sci., vol. 8, p. 375, pl. 31, figs. 5–5b, ♂.

Philodromus exilis KASTON, 1938, Bull. Connecticut Geol. Nat. Hist. Surv., no. 60, p. 191; CHICKERING, 1940, Papers Michigan Acad. Sci., vol. 25, p. 222, figs. 57–59, ♀ ♂; CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 162 (not *exilis* Banks).

For a long time there has been uncertainty in matching up the male with the female of this species. Banks, Petrunkevitch, and others assumed Emerton's *bidentatus* to be the male of what Banks had described from a female as *exilis.* In studying the types and other material at the Museum of Comparative Zoölogy I found that *exilis* is really a synonym of *rufus.* It is true that the type of *exilis* had the legs missing even at the time it was described, but the general appearance of the body and, most important, of its epigynum leaves no doubt as to its real place. On the other hand, the type vial of *placidus* contains two females that exactly match the type male of *bidentatus.* The pattern of markings on legs III and IV offers an excellent character for comparison in this respect. In *exilis* (= *rufus*) legs III and IV do not have these markings.

Philodromus rufus Walckenaer

Philodromus rufus WALCKENAER, 1825, Faun. Française, Aran., p. 91, ♂.

Philodromus exilis BANKS, 1892 (before April), Proc. Acad. Nat. Sci. Philadelphia, p. 63, pl. 2, fig. 40, ♀.

Philodromus pictus EMERTON, 1892 (April), Trans. Connecticut Acad. Sci., vol. 8, p. 373, pl. 31, figs. 2–2h, ♀ ♂.

See discussion under *P. placidus,* preceding.

Philodromus laticeps Keyserling

Philodromus laticeps KEYSERLING, 1880, Spin. Amerikas, Lat., p. 215, pl. 5, fig. 118, ♀.

Philodromus robustus EMERTON, 1892, Trans. Connecticut Acad. Sci., vol. 8, p. 376, pl. 32, figs. 1–1a, ♂; CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 163.

Philodromus louisianus CHAMBERLIN, 1924, Proc. U. S. Natl. Mus., vol. 63, p. 23, pl. 5, fig. 39, ♀.

The type male of *robustus* is the only specimen under that name at the Museum of Comparative Zoölogy. It matches the female of Keyserling's species.

Philodromus washita Banks

Philodromus washita BANKS, 1932, Publ. Oklahoma Biol. Surv., vol. 4, no. 1, p. 28, figs. 1–2, ♀.

Philodromus keyserlingi GERTSCH, 1934, Amer. Mus. Novitates, no. 707, p. 18, fig. 22, ♂; KASTON, 1938, Connecticut Geol. Nat. Hist. Surv. Bull., no. 60, p. 191 (not *keyserlingii* Marx).

I had previously followed Gertsch in supposing this species synonymous with *keyserlingii,* but I now consider the two separate. It is smaller than that species (3.9 to 4.6 mm. as compared with 6 mm. for females) and differs markedly in details of the epigynum. Moreover, that species does not have the white V-shaped mark on the carapace, and has a dark ring at the middle rather than at the ends of the tibiae.

Banks' original material was from Oklahoma; the American Museum of Natural History has a pair from Florida, and I have material from Georgia as well as from several localities in Connecticut.

Salticidae

There has always been difficulty in correctly identifying and placing some of the species originally described by Hentz under *Attus;* in fact many of them have never been placed at all in our modern system. For a number of years I have been especially interested in the spiders of New England, and as several of the unplaced names belong to species that Hentz had from that region I have made attempts to match up, in so far as possible, what he had with what we now find.

In the main we have to proceed on the basis of the colors and pattern as given for the dorsal aspect of the spider, and this brings up several difficulties. First, in this family there is a great deal of sexual dimorphism, so that often males and females were described under separate names (as was done by many workers even long after Hentz). Second, Hentz undoubtedly described juvenile individuals, which may show patterns quite different from the adult. Third, even in the same species different individuals may show considerable variation in pattern; and finally, closely related species though distinguishable by genitalia and secondary sex characters may have the same markings and pattern. This is particularly true with the species of *Metaphidippus*, so many of which were summarily lumped together as synonyms of *capitatus*. In 1892 Banks described, as new, several other species in this same genus (under *Dendryphantes*) and my arrangement as given below is based upon a study (of primarily the genitalia) of his types, as well as of other material at the Museum of Comparative Zoölogy. It is also to some extent based upon a consideration of suggestions made by Miss Bryant and by Dr. Gertsch. It is hoped that sufficient time can be devoted to a study of the group toward the end that a revision of at least the eastern species of *Metaphidippus* can be prepared in the near future.

Metaphidippus capitatus (Hentz)

Attus capitatus HENTZ, 1845, Jour. Boston Soc. Nat. Hist., vol. 5, p. 200, pl. 17, fig. 15, ♂.

Dendryphantes aestivalis EMERTON, 1891, Trans. Connecticut Acad. Sci., vol. 8, p. 228 (in part, not light variety), pl. 17, figs. 2a–2f, ♀ ♂ (not fig. 2).

Dendryphantes capitatus PECKHAM, 1909, Trans. Wisconsin Acad. Sci., vol. 16, p. 469 (in part), pl. 36, figs. 4a–4c (not fig. 4), pl. 38, figs. 5–5a, ♀ ♂.

Metaphidippus capitatus CHICKERING, 1944, Papers Michigan Acad. Sci., vol. 29, p. 172 (in part, not male), figs. 64–65, ♀.

Of the species commonly considered as synonyms of *capitatus* it is agreed that Hentz's *Attus hebes* and *parvus* belong here, and I believe also his *canonicus* (from Massachusetts) which has remained unplaced. Hentz's *octavus*, on the other hand, I now believe to be distinct, agreeing with what I have been calling *insignis* Banks. I likewise consider distinct Banks' *ornatus* and *exiguus*, the females of which, however, are difficult to distinguish from *capitatus*.

Metaphidippus ornatus (Banks)

Dendryphantes ornatus BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 75, pl. 4, fig. 29a, pl. 5, fig. 29, ♀.

Dendryphantes aestivalis EMERTON, 1891, Trans. Connecticut Acad. Sci., vol. 8, p. 228 (in part).

Dendryphantes capitatus PECKHAM, 1909, Trans. Wisconsin Acad. Sci., vol. 16, p. 469 (in part).

Metaphidippus capitatus CHICKERING, 1944, Papers Michigan Acad. Sci., vol. 29, p. 172 (in part, not female), figs. 61–63, ♂.

Metaphidippus octavus (Hentz)

Attus octavus HENTZ, 1846, Jour. Boston Soc. Nat. Hist., vol. 5, p. 365, pl. 22, fig. 15, ♀.

Dendryphantes insignis BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 74, pl. 5, figs. 28–28a, ♀.

Dendryphantes aestivalis EMERTON, 1891, Trans. Connecticut Acad. Sci., vol. 8, p. 228 (in part, light variety), pl. 17, fig. 2, ♀ (not figs. 2a–2f).

Dendryphantes capitatus PECKHAM, 1909, Trans. Wisconsin Acad. Sci., vol. 16, p. 469 (in part), pl. 36, fig. 4, ♀ (not figs. 4a–4c).

Dendryphantes montanus KASTON, 1938, Bull. Connecticut Geol. Nat. Hist. Surv., no. 60, p. 195 (not *montanus* Emerton).

Metaphidippus montanus CHICKERING, 1944, Papers Michigan Acad. Sci., vol. 29, p. 176, figs. 70–73, ♀ ♂ (not *montanus* Emerton).

I believe Hentz's name should be used for this species, which is the one that most distinctly shows the four pairs of spots on the abdomen. Another pair is usually faintly indicated in front of these four.

Metaphidippus exiguus (Banks)

Dendryphantes exiguus BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 75, pl. 5, fig. 30, ♀.

Dendryphantes flavipedes EMERTON, 1913, Bull. Amer. Mus. Nat. Hist., vol. 32, p. 259, pl. 48, fig. 10, ♂ (not *flavipedes* Peckham).

Dendryphantes virginis CHAMBERLIN, 1925, Bull. Mus. Comp. Zool., vol. 67, p. 233, ♂; KASTON, 1938, Canadian Ent., vol. 70, p. 16, figs. 8, 12, 14, ♂; KASTON, 1938, Bull. Connecticut Geol. Nat. Hist. Surv., no. 60, p. 195.

Metaphidippus virginis MUMA, 1944, Amer. Mus. Novitates, no. 1257, p. 11.

In the 1916 revision of his 1892 paper Banks considered this species to be the same as *flavipedes* Peckham, but his comments concerning the lack of markings on the femora indicate that, like Emerton (1913), he was really referring to the species which Chamberlin later described from the male as *virginis*.

Metaphidippus canadensis (Banks)

Icius canadensis BANKS, 1897, Canadian Ent., vol. 29, p. 196, ♀ ♂.

Dendryphantes canadensis PECKHAM, 1909, Trans. Wisconsin Acad. Sci., vol. 16, p. 467, pl. 36, figs. 2–2d, ♀ ♂.

Dendryphantes castaneus EMERTON, 1911, Trans. Connecticut Acad. Sci., vol. 16, p. 407, pl. 6, figs. 5–5a, ♀ (not *castaneus* Hentz).

New England specimens, labeled *castaneus*, in the collection of the Museum of Comparative Zoology, really belong in *canadensis*. Both species have the three black lines on the venter, but they differ in a considerable number of characters, the most obvious one being the greatly thickened front legs in *castaneus*.

Paraphidippus pineus, new species

Figures 54–58

MALE: Total length, 5.7 mm. Carapace, 2.62 mm. long, 2.15 mm. wide. Abdomen, 3 mm. long, 1.7 mm. wide.

In general appearance this species resembles *marginatus* with the carapace brown above, darker along sides and on posterior declivity. On each side is a curved band of white scales, extending from the anterior lateral eyes, under the small eyes, and onto the declivity. This band extends farther back than is usual for *marginatus*, as can be seen by a comparison of figures 54 and 59. Abdomen with a very thin basal white line, the remainder of the dorsum gray brown with iridescent scales. A scutum covering the entire dorsum and without the lateral white bands of *marginatus*, in which species the scutum is shorter and narrower. Venter gray, darker than dorsum. Chelicerae, labium, endites, and sternum dark brown. Leg I with femur dark brown, except at distal end above where it is yellow; the proximal half of patella and of tibia light brown and the distal half blackish brown; metatarsus and tarsus evenly brown. There is a weak fringe of white hairs under the patella and tibia. In the other legs the basal half of the femur is yellow, the distal half dark brown, the patella and tibia are brown, somewhat darker distally, and the metatarsus and tarsus are yellow.

The ocular area occupies 40/92 the length of the carapace, is wider behind than in front (53/58) and with the small eyes 9/13 of the distance between anterior lateral eyes and posterior lateral eyes. These latter form a row 58/71 as wide as the carapace at that level. The chelicerae are powerful, extending forward considerably, with one large prolateral tooth, and a smaller retrolateral tooth, the fang slightly sinuate. The anterolateral corners of the maxillae are drawn out only slightly, not pointed as in *marginatus*. Legs 1423, the first tibia with three pairs of ventral spines, and the metatarsus with two pairs.

The male palp has the patella slightly longer than the tibia, which is armed with an apophysis longer than, but not quite so curved as, in *marginatus*. The embolus is shorter and arises farther from the retrolateral border than in *marginatus*, and is curved ventrad rather than toward the prolateral border.

FEMALE: Total length, 5.9 mm. Carapace, 2.4 mm. long, 1.6 mm. wide.

Besides having the carapace narrower than in the male, the general color is lighter brown, with white hairs distributed more generally over the carapace, some on the clypeus, some in a patch between the rear eyes and with those in the lateral bands sparse so that the bands are not very distinct, yet meet on the declivity behind. The legs are marked as in the male but are lighter; the abdomen is light orange above and yellow beneath. The several pairs of white spots present in *marginatus* are here entirely lacking, and the epigynum has the openings much closer together.

TYPE LOCALITY: Male holotype from Wilton, Connecticut, June 17, 1937. Female allotype from same place June 16, 1938, both collected by G. H. Plumb. Two male paratypes collected with the holotype, and one female paratype collected with the allotype. These specimens were all taken on pine trees. At the Museum of Comparative Zoölogy among unidentified specimens in the Emerton Collection are several females taken at Chatham, Massachusetts, June 10, 1919.

One of the male paratypes (fig. 55) has a carapace which in its lesser width, lighter color, and more diffuse distribution of white scales more nearly resembles the female. Moreover, the chelicerae are far less powerfully developed. This situation is comparable to that in *marginatus* where some males have very powerfully developed chelicerae, and others are more like the females in appearance.

Besides *marginatus* (Walckenaer) and *pineus,* new species, other species belonging to this genus are *aurantius* (Lucas) and *fartilis* (Peckham), both of which were placed by Peckham in *Parnaeus.* In addition, it is probable that *Dendryphantes montanus* Emerton and *Icius nigromaculatus* Keyserling (*D. jeffersoni* Emerton) likewise belong here, rather than in *Metaphidippus.*

Phidippus bryantae, new species

Figures 84, 85

FEMALE: Total length, 12.7 mm.; carapace 4.8 mm. long, 4 mm. wide; abdomen 7.7 mm. long, 5.15 mm. wide.

Carapace dark mahogany brown, darker toward the anterior end, black around the eyes. On the sides extending back from below and behind the rear eyes is a thick band of white scales. The integument is set with many long hairs, sparse on the thoracic part, more numerous on the cephalic, forming dense tufts along the sides below the eyes. Clypeus with long white hairs. Chelicerae brown, slightly iridescent green distally. Sternum orange brown, labium darker. Femora I and II almost all black. Other leg segments dark brown with almost black rings at the ends of the segments, and with many short white scales, and with a dense covering of mixed black and white long hairs. Palpi with thick brushes of white hairs.

Abdomen above with a wide basal band of white continuous on each side with a somewhat narrower lateral band not quite reaching the spinnerets. Between these lateral bands is a tan folium, with small gray maculations. The borders of the folium are notched by extensions of the lateral white, and just in front of the center is a large triangular white spot. Behind this spot is a series of three pairs of small white dots preceded by an unpaired one. From each of these dots arises a long white hair, and there are many long white hairs mixed with black hairs elsewhere along the dorsum and sides. Venter light gray, with a thin white line of scales extending back from the middle of each lung slit to a little over half the distance to spinnerets.

Ocular area somewhat less than one-half the length of carapace (34 72), narrower in front than behind (38 48), where it occupies 48/58 the width of the carapace at that level. Small eyes much closer to the anterior laterals than to posterior laterals (13 29). Chelicera with a single stout tooth on the retromargin of the fang furrow. Sternum almost twice as long as wide (32/18). Labium longer than wide. Tibiae I and II each with 2-2-2 short ventral spines on distal half of segment. Epigynum as figured.

TYPE LOCALITY: Holotype female taken at New Haven, Connecticut, March 15, 1938 (H. Kiley). This spider has the white bands on the cephalothorax as in *variegatus,* and in some specimens of *audax* (the variety *fasciolatus* of Hentz), but its abdominal pattern is more like that of *mystaceus.*

Phidippus audax (Hentz)

Attus audax HENTZ, 1845, Jour. Boston Soc. Nat. Hist., vol. 5, p. 199, pl. 17, figs. 6–7, ♀ ♂.

Attus fasciolatus HENTZ, 1846, *ibid.,* vol. 5, p. 356, pl. 21, fig. 11, ♀.

Phidippus variegatus KASTON, 1938, Bull. Connecticut Geol. Nat. Hist. Surv., no. 60, p. 197 (not *variegatus* Lucas).

Hentz himself, referring to *fasciolatus,* suggested that this "may prove only a variety of" *tripunctatus* (= *audax*). His figure shows the typical pattern on the abdomen and in addition a band of white on each side of the carapace. The Peckhams (1909) and Bryant (1942) have used the presence of these white bands as a character distinguishing *audax* from *variegatus.* However, I have taken specimens of both the typical and the banded variety, in

Connecticut and in Georgia, which agree in details of the palpus and epigynum. The genitalia in *variegatus* are entirely different.

Phidippus insignarius C. L. Koch

Phidippus insignarius C. L. Koch, 1846, Die Arachniden, vol. 13, p. 150, pl. 457, fig. 1206, ♂.

Attus nuttallii Hentz, 1846 (June), Jour. Boston Soc. Nat. Hist., vol. 5, p. 353, pl. 21, fig. 3, ♀.

Hentz's female from Massachusetts was somewhat grayer in appearance than is usual for this species, but the pattern he figured seems distinctive enough, and I have some specimens which almost exactly match it.

Phidippus whitmanii Peckham

Figures 80, 81

Phidippus rufus Peckham, 1888, Trans. Wisconsin Acad. Sci., vol. 7, p. 13 (in part, ♂), pl. 2, fig. 2, ♂ (not ♀, pl. 1, fig. 2a) (not *rufus* Hentz).

Phidippus whitmanii Peckham, 1909, *ibid.*, vol. 16, p. 394, pl. 29, figs. 6–6b, ♀ ♂; Emerton, 1909, Trans. Connecticut Acad. Sci., vol. 14, p. 224, pl. 11, fig. 5, pl. 12, fig. 1, ♀ ♂; Chickering, 1944, Papers Michigan Acad. Sci., vol. 29, p. 200, figs. 117–121, ♀ ♂.

Phidippus insolens Kaston, 1938, Canadian Ent., vol. 70, p. 16; Kaston, 1938, Bull. Connecticut Geol. Nat. Hist. Surv., no. 60, p. 196 (not *insolens* Hentz).

The male of this species is well known and easily recognized because of its bright red color, but there has been some uncertainty regarding the female. Although Peckham states that the latter is "like the male," I have found it much duller, more brown than red, resembling, though less gray than, the female of *princeps*, and on that account had first thought it to be *insolens*. While males are seldom marked with spots on the abdomen, females usually have faintly indicated white spots. The latter pattern is quite distinct on individuals in the penultimate instar. Here the white spots are surrounded with black, as Peckham reports for the females and as shown in figure 80 here, but, as I have had opportunity to observe in several individuals of both sexes, the ground color is brown rather than red. The males when mature all acquire the bright red color, but the females remain brown, though they may lose the spots.

Besides my own reporting of *Phidippus insolens* (Hentz) from New England, which turned out to be an error, there are a number of specimens from New England localities, identified as *insolens* in the collection of the Museum of Comparative Zoölogy. They are males from Petersham, Blue Hills, and Ipswich, Massachusetts, and a study of these proved they were referable to *princeps* (Peckham). The same applies to the males from "S. Mts." Maryland, Fairfax, Virginia, and Catawba, North Carolina. It is true that Peckham had commented on the male of *insolens* being "most closely related to the male of *brunneus* [= *princeps*] from which it must be distinguished by slight differences in the palpus," but he gave no distinguishing characters. He supplied a drawing of the palpus of each species, but I have seen no specimens that *quite* fit either one, though many *could* fit either species. The remaining specimens labeled *insolens* in the collection of the Museum of Comparative Zoölogy are not, in my opinion, either that species or *princeps*.

Phidippus princeps (Peckham)

Figures 82, 83

Attus princeps Peckham, 1883, Description of new and little known spiders of the family Attidae of the United States, p. 18, pl. 2, fig. 14, ♀.

Phidippus brunneus Emerton, 1891, Trans. Connecticut Acad. Sci., vol. 8, p. 225, pl. 16, fig. 2, ♀; Emerton, 1909, *ibid.*, vol. 14, p. 224, pl. 11, fig. 1, ♂.

Phidippus princeps Bryant, 1942, Amer. Midland Nat., vol. 28, p. 701.

Bryant has shown that Emerton's *brunneus* is the same as *princeps*. From Peckham's descriptions under both names in 1909 it is obvious that the females with spots on the abdomen could also fit his description of *insolens*. As pointed out above, nearly all the males labeled *insolens* in the collection of the Museum of Comparative Zoölogy really belong under *princeps*.

In females the abdomen may be light brown to orange, but there is a greater amount of gray pubescence than in the males, and this gray enables them to be distinguished from the very similar *whitmanii* females. The females of *princeps* and *whitmanii* can be easily distinguished by their epigyna, new drawings of which are supplied here.

Evarcha hoyi (Peckham)

Figures 66–68

Attus hoyi PECKHAM, 1883, Description of new or little known spiders of the family Attidae of the United States, p. 7, pl. 1, fig. 5, ♂.

Attus pinus PECKHAM, 1883, *op. cit.*, p. 20, pl. 2, fig. 16, ♀.

Hasarius hoyi EMERTON, 1891, Trans. Connecticut Acad. Sci., vol. 8, p. 243, pl. 21, figs. 2–2g, ♀ ♂.

Pellenes hoyi PECKHAM, 1909, Trans. Wisconsin Acad. Sci., vol. 16, p. 557, pl. 48, figs. 4–4d, ♀ ♂.

Evarcha blanchardi [*sic*] BRYANT, 1941, Psyche, vol. 48, p. 139 (not *blancardi* Scopoli).

In 1905 Banks published an indication that "our one species" which could be included in Simon's genus *Evarcha* was probably the European *paleata* (which I take to be a printer's error for *falcata*). In 1910 he definitely listed *pinus* and *hoyi* as well as his own *latens* (1892) as synonyms of *falcata* Clerck (= *blancardi* Scopoli), and in 1941 Bryant did likewise, besides discussing her reasons for so doing. Simon in his "Arachnides de France" (1937, vol. 6, p. 1271), in a footnote concerning *E. blancardi*, expressed astonishment that this species should have been omitted from the Peckhams' work as he had specimens from Oregon, Georgia, and Colorado. Bryant stated, "Peckham did know it, but he failed to identify it with the common European species." However, I think she misinterpreted Simon's remarks, for he had not indicated that *hoyi* was a synonym of *blancardi*. He undoubtedly considered that there were *two* species in North America and that the Peckhams had simply omitted one of them. Further support of this can be found in his "Histoire naturelle des araignées" (1903) where, in the same paragraph on page 703 of volume 2, he cites *both* species as from North America. Petrunkevitch (1911) omitted *blancardi* from his "Catalog."

Whether we have two species in America or only one, it is certain that *hoyi* is not the same as *blancardi*. Published figures of the epigynum of *hoyi* show that the structure as a whole is much wider, the openings[1] are larger, and they extend farther anteriad than is the case in *blancardi* (as shown in "Arachnides de France," fig. 2022). Likewise, in the palp of *hoyi* there is a thin, spine-like, dark embolus, while in *blancardi* the embolus looks double, or as though paralleled by a conductor (fig. 2015 in "Arachnides de France"), though actually these two darkly pigmented, sclerotized "ribs" are connected by a membranous portion (fig. 63). There is a difference in the tibial apophyses also, that of *hoyi* being somewhat longer, as well as wider distally. I have supplied illustrations for comparison, these new drawings of *blancardi* having been made from specimens collected at Basel, Switzerland. Besides the differences in the genitalia, *hoyi* averages somewhat smaller, 10 males ranging from 4.3 to 5.5 mm., and 13 females from 4.6 to 6.3 mm. In *blancardi* males range from 5 to nearly 7 mm., and females from 6.5 to almost 8 mm. (according to Blackwall, Simon, and O. P.-Cambridge).

Habronattus viridipes (Hentz)

Figures 48, 49, 69

Attus viridipes HENTZ, 1846, Jour. Boston Soc. Nat. Hist., vol. 5, p. 362, pl. 22, fig. 5, ♂.

Attus peregrinus PECKHAM, 1883, Description of new or little known spiders of the family Attidae of the United States, p. 17, pl. 2, figs. 13–13a, ♂.

Habrocestum peregrinum PECKHAM, 1888, Trans. Wisconsin Acad. Sci., vol. 7, p. 61 (in part), pl. 4, fig. 44a, ♂ (not fig. 44 or 44b); EMERTON, 1891, Trans. Connecticut Acad. Sci., vol. 8, p. 245, pl. 20, figs. 6–6b, ♀ ♂.

Habrocestum viridipes PECKHAM, 1888, Trans. Wisconsin Acad. Sci., vol. 7, p. 60 (in part), pl. 4, fig. 43, ♂ (not ♀, fig. 43a).

Pellenes viridipes EMERTON, 1909, Trans. Connecticut Acad. Sci., vol. 14, p. 228, pl. 12, figs. 5–5a, ♀ ♂.

Habronattus peregrinus CHICKERING, 1944, Papers Michigan Acad. Sci., vol. 29, p. 158 (♀ only), fig. 33, ♀ (not ♂).

For a long time this species has been considered as two, *peregrinus* and *viridipes*, and has also at times been confused with *calcaratus*. While in life, leg I of *viridipes* is light green. This color fades after a short time in alcohol, and in all probability Peckham's original description of *peregrinus* was made from a faded type specimen. At any rate comparison of the type with material quite definitely known to be *viridipes* proves them identical. In 1888 Peckham, in his redescription, figured and referred to two different varieties as *peregrinum*. His "variety 1," figure 44a, is like the type with patella III showing the spur arising from near the base of the distal expansion, but his "variety 2," figure 44b, shows the spur arising from the upper ridge of the enlargement, and his figure 44 of the palp represents the species which was later described by Banks as *calcaratus*. In the same paper (1888) Peckham figured the palp of *viridipes* (fig. 43), but his description included no mention of the enlarged patella III or the green front legs. In fact virtually the entire description is of a female belonging to another species.

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[1] Peckham (1909) speaks of the epigynum being "unique, having two large anterior openings, and two other openings behind, near the edge." This statement is based upon a misinterpretation, as in Emerton's drawing, for the anterior circular areas are not openings but areas covering the receptacula.

In his 1909 revision of the family Peckham separated *peregrinus* from *viridipes* on the basis of the former's having solid bands on the abdomen, leg IV longer than I, and tibia I with non-spatulate spines, and the latter's having notched bands, leg IV shorter than I, and tibia I with spatulate spines. I have found that all the males identified as *peregrinus* in the collection of the Museum of Comparative Zoölogy have spatulate spines. While some individuals of *viridipes* have the black and white abdominal bands notched, others show them solid as in the females. I find the lengths of legs I and IV to vary somewhat, but they are nearly the same length.

The palpal organ resembles that of *calcaratus* but the embolus arises farther forward on the retrolateral side of the bulb, and the tibial apophysis is not quite so finely drawn out as in that species. I have taken females mating with males quite definitely *viridipes*, and find that they are identical not only with females labeled *viridipes*, but also with those labeled *peregrinum*, in the collection of the Museum of Comparative Zoölogy. The epigynum has a nearly parallel-sided tubular central structure which is much narrower than in any of our other eastern species.

Habronattus calcaratus (Banks)

Figures 46, 47, 70

Habrocestum peregrinum PECKHAM, 1888, Trans. Wisconsin Acad. Sci., vol. 7, p. 61 (in part), pl. 4, figs. 44, 44b, ♂ (not fig. 44a; not *peregrinus* Peckham 1883).

Pellenes calcaratum BANKS, 1904, Jour. New York Ent. Soc., vol. 12, p. 117, pl. 6, figs. 17, 19, ♀♂.

Habronattus peregrinus CHICKERING, 1944, Papers Michigan Acad. Sci., vol. 29, p. 158 (♂ only), figs. 29–32, ♂ (not ♀).

In his 1909 revision of the family Peckham correctly describes the spur on patella III as coming off from the upper ridge of the enlargement, a condition he had previously (1888) figured for "variety 2" of his *peregrinum*. (His "variety 1" has the spur arising from near the base and is identical with *viridipes*.) Peckham also refers to the abdomen of the male as "spotted," and I have seen specimens from Florida as well as from Michigan which show median white spots one behind the other. But in the specimens from Connecticut and Massachusetts the spots are joined and more or less indistinctly continued before and behind to form a median band of white. The palpal organ resembles that of *viridipes* but has the embolus arising much nearer the proximal end of the bulb, and the tibial apophysis is drawn out more finely.

The female has a pattern more like that of the female *borealis*, and Peckham states that the two species are indistinguishable in this sex. However, I find that the proportions of the epigynal structures are such as to make separation not difficult. Drawings of both are here supplied for comparison. The central conical structure of *calcaratus* is much broader than in *viridipes*, but relatively longer (as is the entire epigynum) than in *borealis*.

Habronattus coronatus (Hentz)

Figures 51, 52

Attus coronatus HENTZ, 1846, Jour. Boston Soc. Nat. Hist., vol. 5, p. 361, pl. 22, fig. 1, ♂.

Pellenes coronatus PECKHAM, 1909, Trans. Wisconsin Acad. Sci., vol. 16, p. 545, pl. 45, figs. 3–3d, ♀♂.

This is the only other species occurring in New England which (besides *viridipes* and *calcaratus*) has leg III modified. The distal end of femur III has a shiny boss, just proximad of which is a tuft of hairs on a prominence; patella III has a stout conical process before the distal end and a short spur at the end; and tibia III is greenish in color. The female is similar in general appearance to *calcaratus* and *borealis*, but may be distinguished by the epigynum in which the central conical structure is proportionately much larger than in those species.

Habronattus decorus (Blackwall)

Figures 53, 71, 72

Salticus decorus Blackwall, 1846 (Jan.), Ann. Mag. Nat. Hist., vol. 17, p. 34, ♂.

Attus roseus Hentz, 1846 (June), Jour. Boston Soc. Nat. Hist., vol. 5, p. 362, pl. 22, fig. 4, ♂.

Habrocestum splendens Emerton, 1891, Trans. Connecticut Acad. Sci., vol. 8, p. 244, pl. 20, figs. 5–5d, ♂.

Pellenes roseus Emerton, 1909, *ibid.*, vol. 14, p. 229, pl. 12, fig. 2, ♀♂; Peckham, 1909, Trans. Wisconsin Acad. Sci., vol. 16, p. 567, pl. 48, figs. 11–11b, ♂; Kaston, 1938, Bull. Connecticut Geol. Nat. Hist. Surv., no. 60, p. 196.

Pellenes splendens Peckham, 1909, Trans. Wisconsin Acad. Sci., vol. 16, p. 569, pl. 47, fig. 2, pl. 48, figs. 8–8a, ♀♂; Comstock, 1912, Spider book, p. 692.

Habronattus decorus Chickering, 1944, Papers Michigan Acad. Sci., vol. 29, p. 155, figs. 25–28, ♀♂.

That *splendens* Peckham is the same as *roseus* Hentz, as indicated by Chickering, is a conclusion to which I myself was led upon studying the type of *splendens* at the Museum of Comparative Zoölogy several years ago. All the females identified (by Emerton) as *roseus* are identical with the type female of *splendens*, not only in pattern but also in structure of the epigynum. In 1909 Peckham supplied drawings of the palpi of both *splendens* and *roseus*. The chief difference would seem to be in the structure of the tibial apophysis, but his drawings do not quite fit any of the specimens examined by me, and I have found males labeled *roseus* exactly matching those labeled *splendens*. On the basis of its dark iridescent cephalothorax, *splendens* was separated from *roseus*, which is stated to have white scales and no iridescence. I have found, however, that in examining a large enough series one may see all gradations between these two conditions, according to how much the specimen has had the pubescence rubbed off. The same applies to the distinctness of the abdominal pattern.

Nebridia borealis (Banks)

Figures 77–79

Sidusa borealis Banks, 1904, Jour. New York Ent. Soc., vol. 12, p. 116, pl. 6, fig. 18, ♂; Peckham, 1909, Trans. Wisconsin Acad. Sci., vol. 16, p. 593, pl. 47, fig. 10, ♂.

It is my belief that this species belongs in *Nebridia* Simon rather than in *Sidusa* where it was placed by Banks. The Peckhams had not seen a specimen but merely copied Banks' description, which, however, fails to mention many characters of generic importance in this group. In *Sidusa* the carapace is widest at the first row of eyes, the ocular quadrangle occupies three-fifths of the length of the carapace, the anterior eye row is slightly procurved, the posterior eyes form a row as wide as the carapace at that place, and metatarsus I has lateral as well as ventral spines. However, in *borealis* the posterior eyes form a row which is narrower than the carapace, the latter is widest just behind these eyes, the ocular quadrangle occupies less than half the length of the carapace, the anterior eye row is recurved, and metatarsus I is devoid of lateral spines.

GERTSCHIA, NEW GENUS

The carapace is flat and low, its greatest height being about one-third the length, its width from two-fifths to two-thirds the length. The ocular quadrangle occupies two-thirds to almost three-fourths the length of the carapace and is approximately as wide in front as behind where it occupies almost, or quite, four-fifths the width of the carapace at that level. The small eyes of the second row are much nearer the anterior lateral eyes than the posterior lateral eyes. The sternum is oval, about one and a half times as long as broad, truncate in front so that the anterior coxae are separated by their width. The labium is slightly wider than long, and the fang furrow of the chelicera has a bicuspid tooth. While the carapace is devoid of a constriction the abdomen has one about one-third the length back.

GENOTYPE: *Synemosyna noxiosa* Hentz.

This genus is erected in the belief that Hentz's *S. noxiosa* differs sufficiently from *picata* and *americana* to warrant its removal from the genus *Peckhamia* in which it has been placed by Peckham and later American authors, who have erroneously considered it a synonym of *scorpionia*. In the discussion of his newly erected genus *Peckhamia*, Simon (1903, "Histoire naturelle des araignées," vol. 2, p. 496) calls attention to the convex pars cephalica and the very distinct constriction behind the eyes, both characters being well shown in his figure 584 of the genotype, *scorpionia*. While from the proportions of the abdomen the drawing could well be of the same species figured by Hentz as *scorpionia*, neither drawing fits what Peckham, Emerton, *et al.*, have been calling *scorpionia*. The spider referred to by these and later authors has a much shorter abdomen and, as in Hentz's *noxiosa*, no constriction on the cephalothorax. This makes it much less ant-like than the true *Peckhamia* species (compare figs. 73 and 74).

The species described by Gertsch in 1934 as *Peckhamia idahoana* undoubtedly belongs in *Gertschia*. It differs from *noxiosa* in having leg I rather than leg IV longest, in having the retromarginal tooth simple rather than bicuspid, in having three pairs of spines under tibia I rather than two or three spines, and in having a simple tibial apophysis, rather than a double-pronged one.

To the genus *Peckhamia* belong: *picata* (Hentz), *americana* (Peckham), and *seminola* Gertsch, besides the genotype. These spiders differ from *Gertschia* in that the carapace is convex in the cephalic region, the greatest height about two-fifths the length, and is narrower, with the greatest width barely more than half the length. The length of the ocular quadrangle is from half to three-fifths that of the carapace, and it is very slightly narrower in front than behind, where it is virtually the width of the carapace at that level. The sternum is over twice as long as wide, narrowed in front so that the anterior coxae are separated by less than the width of one, and the labium is as long as wide.

Both *Peckhamia* and *Gertschia* belong in that division of the family, the Fissidentati, in which the retromargin of the chelicera has a tooth divided into two or more cusps. Yet *G. idahoana* is unidentate, and I have seen specimens of *P. picata* that were unidentate. Many others of our eastern genera are quite variable in this respect. Though *Peckhamia* was first included by Simon in the Pluridentati, it was later transferred to the Fissidentati, to which Petrunkevitch refers our *Hentzia*, *Nebridia*, *Onondaga*, *Maevia*, and *Zygoballus*. At first, following Simon, Petrunkevitch (in the "Systema aranearum," 1928) had considered *Hentzia* unidentate. But Comstock (1912) had shown that *H. palmarum* is fissidentate, and in 1930 Petrunkevitch found for both *palmarum* and *mitrata* that while most males may be unidentate, other males and all females are fissidentate. "Close inspection of most males of different species reveals that the tooth has a slight lateral projection at [the] end, which can be interpreted only as a rudiment of the second cusp present in females." Of the individuals of *palmarum* and *mitrata* examined by me, the females were all fissidentate and the males unidentate except for one male of *mitrata* which was fissidentate on one chelicera and unidentate on the other. I find *Maevia vittata* truly fissidentate and *Nebridia borealis* likewise, although Banks, writing of the retromargin in *borealis*, refers to "one simple distinct tooth." The genus *Fuentes*, presumably fissidentate, has had removed from it to *Onondaga* the species *lineata*, which I find often unidentate, and I note that Comstock found likewise for *taeniola*, which had been removed to *Metacyrba*. In *Zygoballus nervosus* I find both sexes unidentate, while in *Z. bettini* the females are fissidentate and the males unidentate, a situation similar to that in *Hentzia*.

The genera placed in the Pluridentati include our *Ballus*, *Synemosyna*, and *Myrmarachne*. Yet all the specimens of *B. youngii* I have examined are unidentate. Comstock's specimens of *S. formica* had bicuspid or tricuspid teeth, hence were fissidentate. Several examined by me were fissidentate, some were pluridentate, and one was fissidentate on one chelicera and pluridentate on the other! I find specimens of *M. hentzi* to be unidentate.

Most of our genera have been placed in the Unidentati. But the Peckhams called attention to the fact that in *Icius*, *wickhamii* is fissidentate, and in *Thiodina* there is considerable variation. "In some the tooth is compound, in others single, and in a few there are several teeth. Even the two falces in the same specimen are occasionally unlike." The Peckhams state that the tooth is lacking completely in *Euophrys*, but I have shown that there is one present in *E. nearctica*, and find that the type female of *E. diminuta* also has one.

Obviously the nature of the cheliceral armature can have only a limited application in this family.

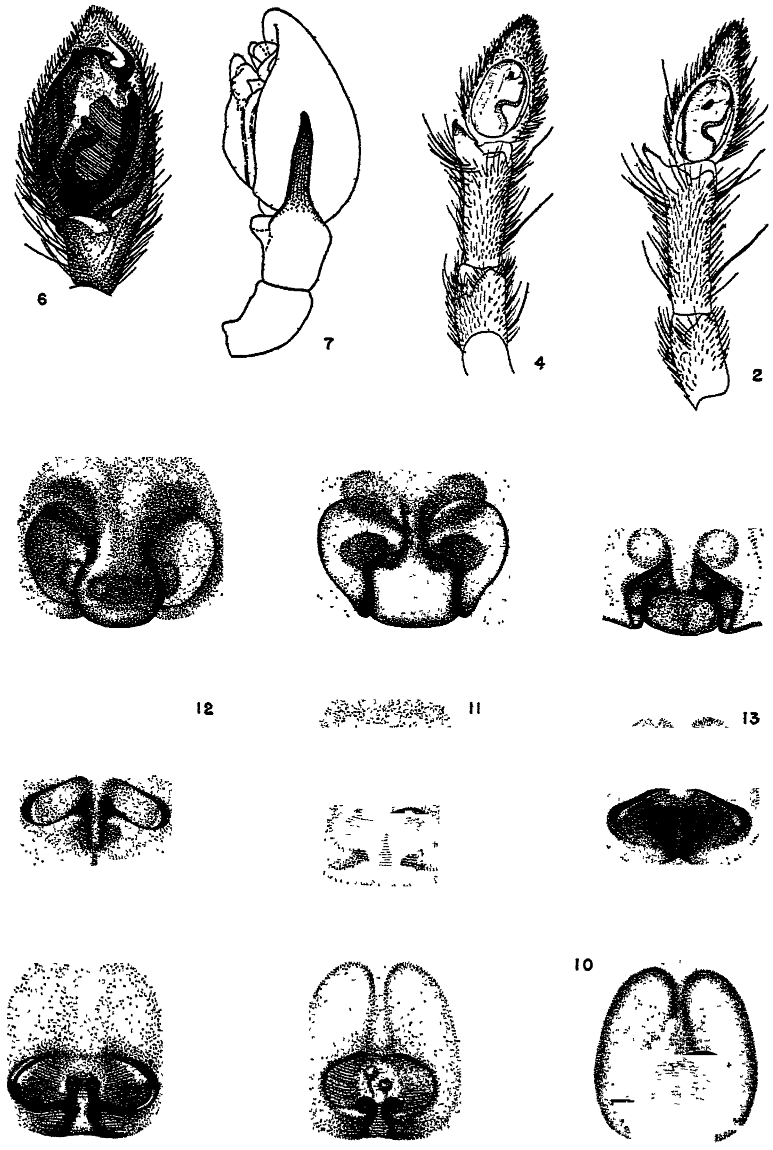
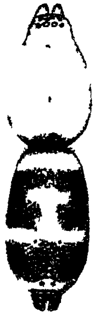
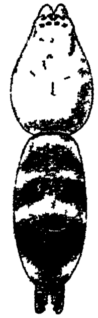


Fig. 1. *Drassodes auriculoides* Barrows, epigynum.
Fig. 2. Idem, palpus, ventral aspect.
Fig. 3. *Drassodes robinsoni* Chamberlin, epigynum.
Fig. 4. *Drassodes neglectus* (Keyserling), palpus, ventral aspect.
Fig. 5. *Geodrassus gosiutus* (Chamberlin), epigynum.
Fig. 6. *Zelotes inheritus*, new species, palpus, ventral aspect.
Fig. 7. Idem, palpus, retrolateral aspect.
Fig. 8. *Sergiolus decoratus*, new species, epigynum.
Fig. 9. *Sergiolus variegatus* (Hentz), epigynum.
Fig. 10. *Sergiolus decipiens* Chamberlin, epigynum. Florida specimen.
Fig. 11. *Sergiolus unimaculatus* Emerton, epigynum.
Fig. 12. *Sergiolus famulus* Chamberlin, epigynum.
Fig. 13. *Sergiolus meretrix* Chamberlin, epigynum. Alabama specimen.





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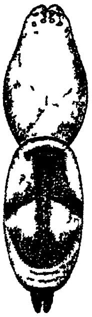

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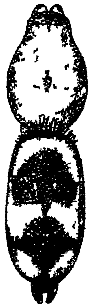

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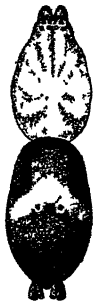

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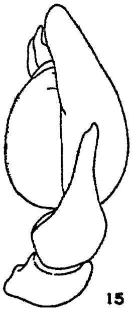

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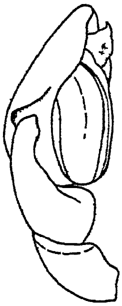

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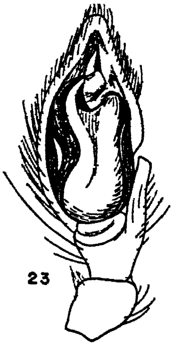

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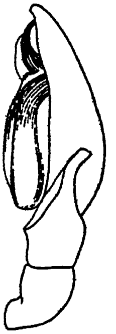

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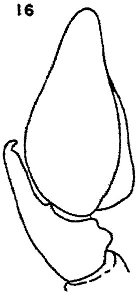

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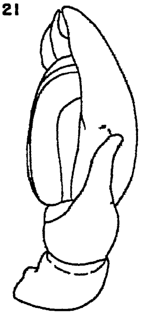

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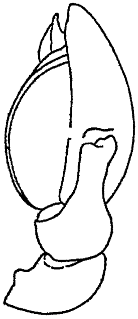

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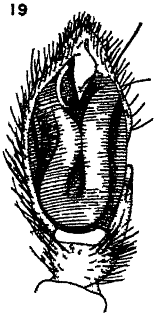
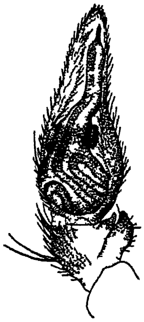


Fig. 14 *Sergiolus variegatus* (Hentz), dorsal view of male
Fig 15. Idem, palpus, retrolateral aspect.
Fig. 16 Idem, palpus, dorsal aspect
Fig 17 *Sergiolus decoratus*, new species, dorsal view of male
Fig. 18 Idem, palpus, retrolateral aspect.
Fig. 19 Idem, palpus, ventral aspect.
Fig. 20 *Sergiolus famulus* Chamberlin, dorsal view of male.
Fig 21. Idem, palpus, retrolateral aspect
Fig. 22 *Sergiolus meretrix* Chamberlin, dorsal view of male. Type specimen.
Fig. 23 Idem, palpus, ventral aspect Same specimen.
Fig. 24 Idem, palpus, retrolateral aspect Same specimen
Fig. 25 *Sergiolus unimaculatus* Emerton, dorsal view of male. Type specimen.
Fig. 26 Idem, palpus, retrolateral aspect. Same specimen.



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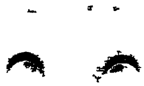

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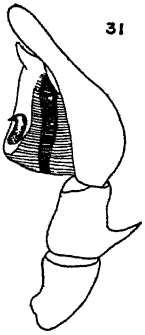

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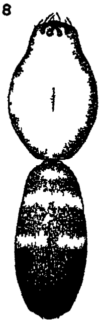

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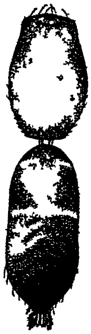

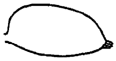

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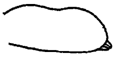

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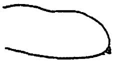

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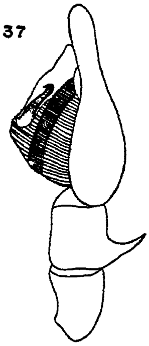

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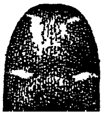

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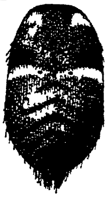

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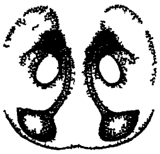

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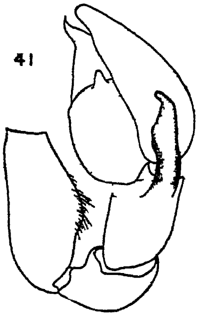

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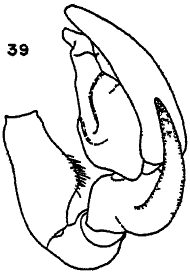

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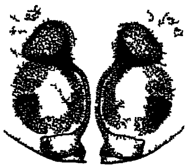
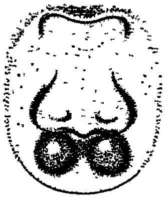


Fig 27 *Castianeira gertschi* new species palpus ventral aspect.
Fig 28 Idem dorsal view of male
Fig 29 Idem epigynum
Fig 30 *Micaria aurata* (Hentz) dorsal view of male.
Fig 31 Idem palpus lateral aspect
Fig 32 Idem female dorsal view of abdomen
Figs 33 34 35 Idem, abdomens of different females from side, to show variation in amount of constriction
Fig 36 *Micaria longipes* Emerton female dorsal view of abdomen
Fig 37 Idem palpus lateral aspect Type specimen
Fig 38 *Phrurotimpus alarius* (Hentz) epigynum
Fig 39 Idem palpus retrolateral aspect
Fig 40 *Phrurotimpus borealis* (Emerton), epigynum
Fig 41 Idem retrolateral aspect



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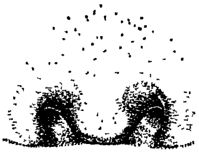

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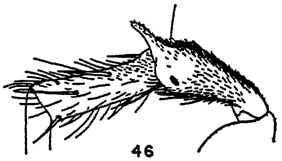

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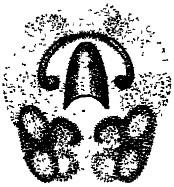

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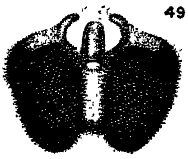

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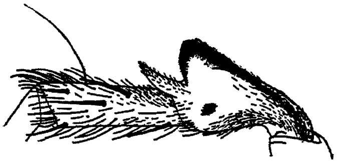

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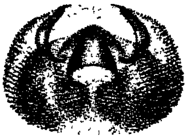

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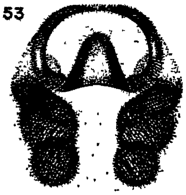

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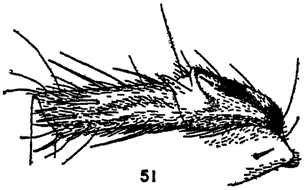

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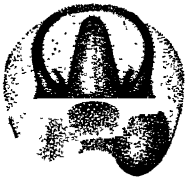

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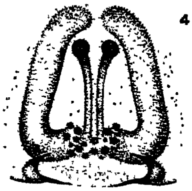

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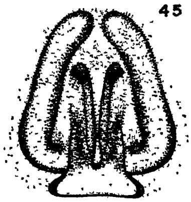

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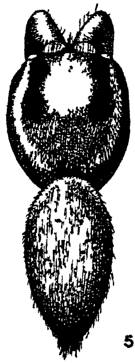
Fig. 42. *Zelotes inheritus*, new species, epigynum.
Fig. 43. *Clubiona elizabethae*, new species, epigynum.
Fig. 44. *Micaria aurata* (Hentz), epigynum.
Fig. 45. *Micaria longipes* Emerton, epigynum.
Fig. 46. *Habronattus calcaratus* (Banks), patella and tibia III of male.
Fig. 47. Idem, epigynum. Type specimen.
Fig. 48. *Habronattus viridipes* (Hentz), patella and tibia III of male.
Fig. 49. Idem, epigynum.
Fig. 50. *Habronattus borealis* (Banks), epigynum.
Fig. 51. *Habronattus coronatus* (Hentz), patella and tibia III of male.
Fig. 52. Idem, epigynum.
Fig. 53. *Habronattus decorus* (Blackwall), epigynum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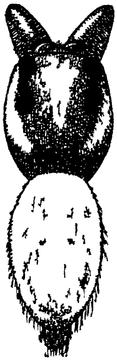
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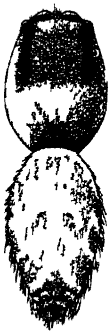
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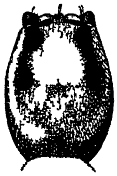
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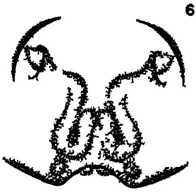
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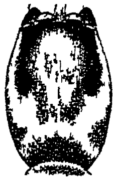
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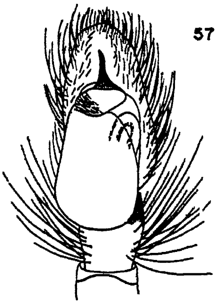
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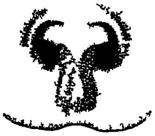
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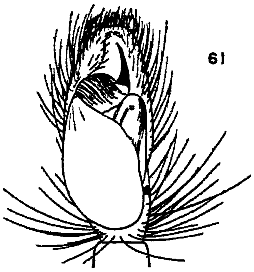
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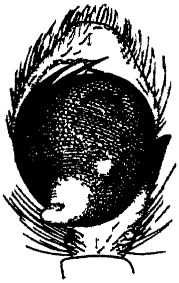
Fig. 54 *Paraphidippus pineus*, new species, dorsal view of male
Fig. 55 Idem, carapace of another male
Fig. 56 Idem, carapace of female
Fig. 57 Idem, palpus, ventral aspect
Fig. 58 Idem, epigynum
Fig. 59 *Paraphidippus marginatus* (Walckenaer), dorsal view of male
Fig. 60 Idem, dorsal view of female
Fig. 61 Idem, palpus, ventral aspect
Fig. 62 Idem, epigynum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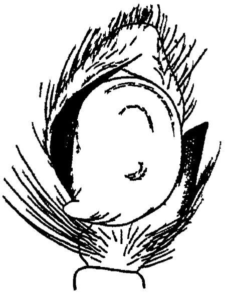
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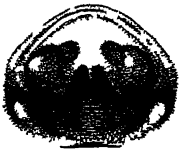
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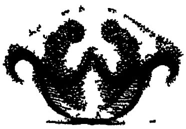
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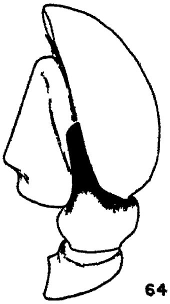
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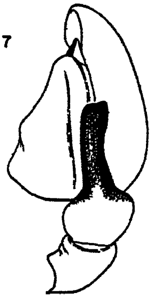
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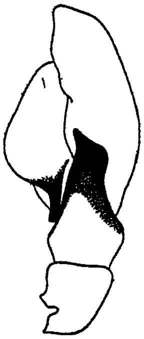
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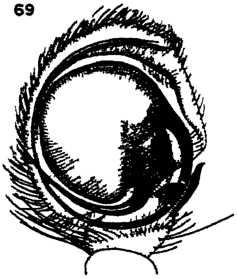
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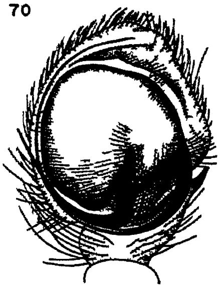
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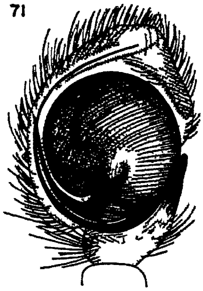
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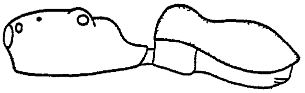
Fig 63 *Evarcha blancardi* (Scopoli), palpus, ventral aspect
Fig 64 Idem palpus retrolateral aspect
Fig 65 Idem epigynum
Fig 66 *Evarcha hoyi* (Peckham) palpus ventral aspect
Fig 67 Idem palpus retrolateral aspect
Fig 68 Idem epigynum
Fig 69 *Habronattus viridipes* (Hentz), palpus, ventral aspect
Fig 70 *Habronattus calcaratus* (Banks), palpus ventral aspect
Fig 71 *Habronattus decorus* (Blackwall) palpus ventral aspect
Fig 72 Idem palpus retrolateral aspect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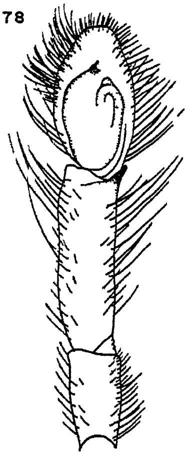
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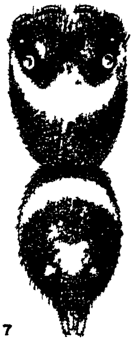
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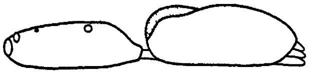
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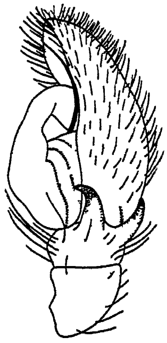
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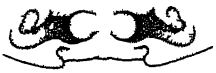

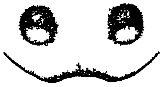
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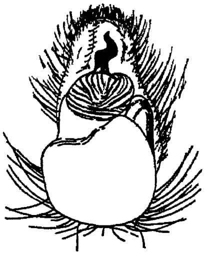
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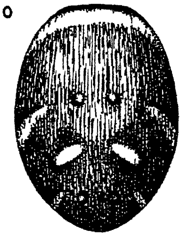
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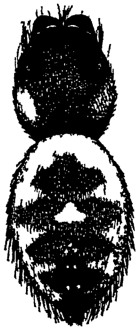
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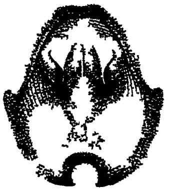
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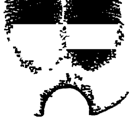
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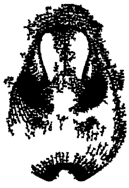
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Fig 73 *Peckhamia picata* (Hentz), lateral aspect of male
Fig 74 *Gertschia noxiosa* (Hentz), lateral aspect of male
Fig 75 Idem, palpus, retrolateral aspect
Fig 76 Idem, epigynum
Fig 77 *Nebridia borealis* (Banks), dorsal view of male
Fig 78 Idem, palpus, ventral aspect
Fig 79 Idem epigynum
Fig 80 *Phidippus whitmanii* Peckham immature male, dorsal view of abdomen
Fig 81 Idem epigynum
Fig 82 *Phidippus princeps* (Peckham), palpus ventral aspect
Fig 83 Idem, epigynum
Fig 84 *Phidippus bryantae*, new species dorsal view of female
Fig 85 Idem, epigynum

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THE PSEUDOSCORPION SUBFAMILY OLPIINAE

BY C. CLAYTON HOFF[1]

The present study is concerned primarily with new genera and species of Olpiinae from the West Indies. The insular pseudoscorpion fauna of this region is poorly known, being subjected to no more than an incidental and precursory examination by a few authors. It is no surprise, then, to find that collections from the West Indies contain predominantly species that are new to the literature. Certainly the number of new species described here is insignificant in relation to the species that remain undescribed in the islands of the West Indies.

This study is based on material submitted to the writer by the American Museum of Natural History and completes the study and description of Neotropical Diplosphyronida in the American Museum collections. Types, all of which are mounted in Canada balsam, are deposited in the American Museum of Natural History.

SUBORDER DIPLOSPHYRONIDA CHAMBERLIN

OLPIIDAE CHAMBERLIN

Olpiinae Banks, emend.

Olpiinae BANKS, 1895, Jour. New York Ent. Soc., vol. 3, pp. 2, 10 (*pro parte*). CHAMBERLIN, 1930, Ann. Mag. Nat. Hist., ser. 10, vol. 5, pp. 588, 598. CHAMBERLIN, 1931, Stanford Univ. Publ., Univ. Ser., Biol. Sci., vol. 7, no. 1, p. 225. BEIER, 1932, Das Tierreich, vol. 57, p. 179. ROEWER, 1937, *in* Bronn, H. G., Die Klassen und Ordnungen des Tierreichs, vol. 5, div. 4, book 6, no. 2, pp. 259–260.

The diagnosis of this subfamily has undergone considerable change since its establishment by Banks. In 1930 Chamberlin formulated the modern concept of this category by greatly restricting the diagnosis to include only those Olpiidae that have entire arolia (designated as empodia by Chamberlin in 1930), undivided tergites and sternites, and a cheliceral flagellum of three blades or setae. In 1932 Beier found it necessary to alter the diagnosis to include forms that have a flagellum of four setae. With the inclusion of the present new genus *Neopachyolpium*, the Olpiinae must be further amended to include forms that have only two setae in the flagellum.

REVISED DIAGNOSIS: Tergites and sternites undivided; flagellum with three, seldom with two or four, setae; arolia simple, undivided.

In order to facilitate future work in the Olpiinae and to indicate intergeneric relationships, the inclusion of a key to the genera of the subfamily seems advisable. This key is based in part on the one by Roewer (1937). Since the genera fall into two natural groups characterized by the nature of the pars basalis and pars tibialis of the first leg, two tribes are established as indicated in the key.

KEY TO GENERA OF THE SUBFAMILY OLPIINAE

1. First leg with pars tibialis plainly shorter than the pars basalis, the two parts separated by a freely movable joint (tribe Olpini).......2

   First leg with pars tibialis subequal to, or longer than, pars basalis, the nature of the joint between the two femoral parts allowing only restricted movement (tribe Xenolpini)........................11

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[1] Quincy College, Quincy, Illinois. This study was completed with the help of a Grant-in-Aid from the Sigma Xi Research Fund. The writer is indebted to the Reverend Pacific Hug, O.F.M., Ph.D., for a translation from the Italian of a part of Balzan's (1890) publication.

2. Palpal femur without a dorsal tactile seta..........................3

Palpal femur with a dorsal tactile seta..........................7

3. Venom ducts long, nodus ramosus of fixed finger proximal to tactile seta *it*.....................Genus ....*Hesperolpium* Chamberlin, 1930

Venom ducts short, nodus ramosus of fixed finger not proximal to tactile seta *it*........................4

4. Abdominal tergites with 8–12 heavy marginal setae.................Genus *Parolpium* Beier, 1931

Abdominal tergites with 2–4, at the most 6, small marginal setae.....5

5. Fixed chelal finger with tactile setae of internal series (*it*, *ist*, *isb*, and *ib*) grouped together at base of finger...Genus *Thaumatolpium* Beier, 1931

Tactile setae of internal series not forming a group at the base of the fixed finger....................6

6. The tactile seta *it* of the fixed chelal finger is clearly distad to *esb*.........Genus *Olpium* Koch, 1873

The seta *it* and *esb* are almost opposite each other.........................Genus *Minniza* Simon, 1881

7. Each middle tergite with 10–16 heavy marginal setae..................8

Each middle tergite with at most 6 small marginal setae............10

8. Tactile seta *ist* of fixed chelal finger clearly distad of *est*.............. Genus *Apolpium* Chamberlin, 1930

Tactile seta *ist* proximal to *est*......9

9. Subapical lobe of cheliceral finger conical, short, blunt...............Genus *Pachyolpium* Beier, 1931

Subapical lobe claw-like, slender, very long, directed parallel to the apical tooth.................. Genus *Neopachyolpium*, new genus

10. Venom ducts short, nodus ramosus of fixed finger distal to tactile seta *it*......Genus *Olpiolum* Beier, 1931

Venom ducts long, nodus ramosus of fixed finger clearly proximal to tactile seta *it*.................. Genus *Calocheirus* Chamberlin, 1930

11. The subapical lobe of the movable cheliceral finger simple and undivided.....................12

The subapical lobe of the movable cheliceral finger secondarily divided into two or more small lobes.....14

12. No tactile seta on dorsal surface of palpal femur.................. Genus *Xenolpium* Chamberlin, 1930

At least one tactile seta on the dorsal surface of the palpal femur......13

13. One tactile seta on dorsal surface of palpal femur................... Genus *Euryolpium* Redikortzev, 1938

Two tactile setae on dorsal surface of palpal femur......................Genus *Indolpium*, new genus

14. No tactile setae on the dorsal surface of the palpal femur................Genus *Horus* Chamberlin, 1930

Two long and well-separated tactile setae (areoles weak; setae often fragile and broken) on the dorsal surface of the palpal femur..........Genus *Novohorus*, new genus

PACHYOLPIUM BEIER, EMEND.

Pachyolpium BEIER, 1931, Mitt. Mus. Zool. Berlin, vol. 17, p. 310. BEIER, 1932, Das Tierreich, vol. 57, p. 193. ROEWER, 1937, *in* Bronn, H. G., Die Klassen und Ordnungen des Tierreichs, vol. 5, div. 4, book 6, no. 2, pp. 261–262.

REVISED DIAGNOSIS: Cephalothorax longer than wide, without cross furrows; each central tergite with usually 10–14 marginal setae; cheliceral flagellum with three setae; subapical lobe of chelicera stout and blunt; palpus moderately stout; palpal femur with a dorsal sensory seta near the base; sensory seta *est* near midpoint or proximal to midpoint of fixed finger, *et* and *it* distal to *est*; *ist* proximal to *est* and often near the finger base; pars basalis of first leg a little longer than, to almost twice as long as, the pars tibialis, the joint between the two allowing free movement; typically a Neotropical genus.

For the convenience of future workers and in order to point out interspecies relationships within the genus *Pachyolpium*, the following key is given to species known in the genus. In addition to the species included in the key, it is possible (*fide* Beier, 1932) that *Olpium minutum* Banks, 1908, and *O. obscurum* Banks, 1893, may also belong to this genus. Incompleteness of the original descriptions, however, precludes definite assignment of these two species to the present genus until the type specimens can be examined. While a generic assignment cannot be made on the descriptions available, it is apparent that none of the specimens described here belong to either of Bank's species.

KEY TO THE SPECIES OF THE GENUS *Pachyolpium*

1. Length of movable chelal finger 0.4 mm. or less; palpal tibia 0.45 mm. or less in length; length: width ratio of palpal femur 2.5 or less; body length 2 mm. or less 2
   Length of movable finger 0.4 mm. or more; palpal tibia 0.5 mm. or more in length; length : width ratio of palpal femur 2.6 or more (except *P. adiposum* Hoff, 1945); body size variable, usually (but not always) greater than 2 mm. 4
2. Movable finger of chela 0.26 mm. long, shorter than hand without base (reported from Paraguay) . . . . . . *P. brevifemoratum* (Balzan, 1890)
   Finger length 0.35 mm. or greater, subequal to length of hand without pedicle (reported from West Indies) 3
3. Tibia of palp slightly shorter than the femur; length: width ratio of palpal femur 2.5; width of chela 0.25 mm. . . . . *P. incertum* Beier, 1931
   Tibia of palp slightly longer than femur; length: width ratio of palpal femur 2.3 or less; width of chela about 0.31 mm. . . . . *P. brevipes* (With, 1907)
4. Length: width ratio of palpal femur 2.7 or less 5
   Length: width ratio of palpal femur 2.8 or more 8
5. Length: width ratio of palpal femur 2.35 . . . . . *P. adiposum* Hoff, 1945
   Length: width ratio of palpal femur 2.6 to 2.7 6
6. Femur and tibia 0.7 mm. or more in length . . . ♀ *P. arubense* Beier, 1936
   Femur and tibia 0.6 mm. or less in length 7
7. Body less than 2 mm. long; tibia 2.3 times as long as wide . . . . *P. reimoseri* Beier, 1931
   Body of male about 2 mm. long, female longer; tibia 2.4 to 2.45 times as long as wide . . . . *P. puertoricensis*, new species
8. Body length less than 2 mm.; length of movable chelal finger less than 0.5 mm. . . . . *P. confundens*, new species
   Body length 2.2 mm. or more; length of movable chelal finger more than 0.5 mm. 9
9. Tibia with length 0.8 mm. or more; femur more than 0.78 mm. long . . . . *P. erratum* Beier, 1931
   Tibia and femur length 0.7 mm. or less 10
10. Length of palpal femur about 0.9 of the length of the tibia . . . . *P. furculiferum* (Balzan, 1891)
    Palpal femur and tibia subequal in length 11
11. Movable finger of chela less than 0.55 mm. long, length of chela 2.6 times the width . . . . ♂ *P. arubense* Beier, 1936
    Movable finger of chela more than 0.55 mm. long, usually 0.6 mm. or more; length of chela 2.65 or more times the width 12
12. Inner margin of palpal femur convex; movable finger of chela shorter than hand with pedicle . . . . *P. crassichelatum* (Balzan, 1890)
    Inner margin of palpal femur very weakly convex; movable finger of chela subequal to the length of the hand with pedicle 13
13. Length of palpal femur 3 times the width; movable finger of chela more than 0.66 mm. long; length of palpal tibia 0.7 mm. . . . . *P. aureum*, new species
    Length of palpal femur 3.05 or more times the length; length of movable finger of chela less than 0.65 mm.; length of palpal tibia less than 0.68 mm. . . . . *P. medium*, new species

Pachyolpium aureum, new species

Figures 1–4

MALE: Moderately stout; abdomen and legs yellow to golden; carapace and palps deep golden to reddish brown color; body length 2.7–2.8 mm. Carapace smooth except for very weak granules on the sides behind the eyes; setae sparse; posterior margin nearly straight, with four setae separated from the margin by a narrow unpigmented band; lateral margins convex; carapace narrowed near the eyes; short anterior margin with a small and weakly developed median sinuation, a pair of submedial setae and one seta at each anterior-lateral corner; the eyes of each pair subequal in size, separated by about one-half the longitudinal diameter of the anterior eye; the anterior eye removed from the anterior margin of the carapace by slightly more than the diameter of the eye; length of carapace about 0.8 mm.; greatest width 0.68 mm. near the posterior one-fourth, posterior width slightly less; ocular width 0.48 mm. Abdomen ovate, about 2 mm. long, width about one-half of the length; tergites with very weak net-like markings; the anterior two tergites little sclerotized; first tergite with four marginal setae, the second with six or eight; sternites with net-like lines and setae more weakly developed than those of the tergites; s ernites of central portion of abdomen with a marginal row of about 10 setae; a marginal row of four setae near the center of the fourth sternite and another seta just mesial to each stigmatic plate; stigmatic plates asetaceous.

Chelicera: Base fairly stout, smooth; all five basal setae long and acute; flagellum of three blades, the longest very heavy and bearing 12–15 denticulations along the distal half of the anterior margin; the central flagellar blade more seta-like, a little more than one-half the length of the first, apparently with one or two very fine subterminal microdenticulations; the third flagellar blade similar to the central one but slightly shorter. Fixed finger well curved; lamina exterior with evenly convex outer margin; apical tooth sclerotic, brown in color, with a very weak denticle on the inner margin of the tooth; five or six flat retroconical marginal teeth confined to the distal half of the inner margin of the finger and continuous with the small denticle of the apical tooth; serrula interior very transparent, most teeth fused to form a velum; distal tooth of serrula modified to form a spine-like structure located near the level of the center of the row of marginal teeth and directed toward the subapical tooth of the opposing finger. Movable finger fairly stout, outer margin weakly convex, inner margin concave; serrula exterior of 23–25 ligulate plates; apical tooth brown in color, sclerotic; subapical lobe very near the base of the apical tooth, blunt, fairly stout; galea trifurcated near the terminal fifth, the rami simple, gently curved, and finger-like; galeal seta inserted between the subapical lobe and the base of the galea, about equal in length to the galea.

Palpus: Maxilla stout; smooth, few setae; apical process with a strong terminal seta, a well-developed seta near the outer margin at about the midpoint of the process, and several smaller setae on basal portion; length of maxilla 0.45–0.47 mm., between 1.6 and 1.8 times the width. Trochanter stout; inner margin smooth, with several long setae; outer margin almost straight distal to the pedicle, a few granules near the outer distal corner, setae sparse and stout; length 0.355–0.38 mm., 1.42 times the width. Femur with pedicle wider than long; dorsal sensory seta well within the basal one-third of the podomere; smooth except for small scattered granules on the flexor surface; setae fairly numerous, longer on the flexor than on the extensor surface; extensor margin centrally straight; flexor margin convex proximal to the distal third, in the distal third very slightly concave; length 0.705 mm.; width greatest just proximal to the midpoint, 0.228 mm. in the holotype, 0.235 mm. in the paratype; length 3 to 3.1 times the width. Tibia with very few inconspicuous granules on the flexor surface; setae fairly numerous; pedicle stout; inner margin of tibia straight to weakly convex proximal to the distal one-third, very weakly concave beyond; outer margin flatly convex basal to the distal fourth, slightly more convex beyond; tibia of holotype 0.705 mm. long, 0.285 mm. wide, length 2.47 times the width; tibia of paratype 0.7 mm. long, 0.29 mm. wide, length 2.4 times the width. Chela of same color as rest of palp; hand stout, fingers slender and gently curved; pedicle displaced toward the outside; external margin flatly convex; the inner margin more evenly convex and rounded; long acuminate setae fairly numerous especially on the inner surface of the hand; chela smooth except for small but densely crowded granules on the distal two-thirds of the inner surface; chela about 1.2 mm. long, 0.415 mm. wide, length 2.85 to 2.9 times the width; length of hand without pedicle 0.575–0.59 mm.; depth of hand about 0.42 mm.; length of movable finger 0.68 mm. Chela from the side stout; the pedicle nearer the ventral side; the ventral margin weakly convex; dorsal margin rounded, especially near the base; movable finger slender, with evenly convex inner and evenly concave outer margin; fixed finger more stout, tapering distally, inner margin weakly convex, outer margin very weakly concave in the central portion; each finger with a well-developed lamina defensor. Fixed finger with about 40 teeth arranged along almost the entire inner margin; the teeth at the anterior end of the row small, heavily cusped, and conical; in the distal third of the row the teeth become wider and retroconical; at the proximal end of the row, the teeth become much flattened and with a heavy sclerotized cusp extending along the entire free margin of each tooth; nodus ramosus proximal to *et* about as far as the latter is from the finger tip. Movable finger with teeth similar in number and shape to those of the fixed finger; nodus ramosus on a level about two areolar diameters distal to *t*. Fixed finger with eight sensory setae; *et* within the distal one-eighth of the finger, *est* somewhat proximal to the midpoint, *it* on a level about one-third of the distance from *est* to the finger tip; *ist* on a level considerably proximal to *est* and between two and one-half and three times as far from the finger tip as from the level of *ib; isb*, *esb*, and *eb* forming a group of three setae on the external surface at the base of the finger; *ib* on the dorsal surface of the finger near the base on nearly the same level as *isb*. Movable finger with *t* about one-fourth of the finger length from the tip, *st* about two and one-half times farther than *t* from the finger tip, *sb* between one-sixth and one-fifth of the finger length from the base, *b* about three areolar diameters proximal to *sb*.

Legs: Smooth; yellowish color; setae acuminate. First leg: trochanter subtriangular, no pedicle, extensor surface short and straight, flexor surface distally convex but proximally a little concave, length 0.19 mm., depth 0.167 mm.; pars basalis of femur elongate, flexor margin very weakly convex, extensor margin with a marked concavity at about the distal third, deepest at the distal end, length 0.34 mm., depth 0.123–0.13 mm.; pars tibialis much shorter than the pars basalis, extensor margin flatly convex, flexor margin nearly straight in the center, deepest near the distal end, length 0.19–0.2 mm., depth 0.12 mm.; tibia with a very weakly concave extensor margin, flexor margin evenly convex, setae fairly numerous, length 0.28–0.29 mm., depth about 0.085 mm., length 3.25 to 3.45 times the depth; metatarsus subcylindrical, flexor margin very weakly convex, extensor margin a little concave, length 0.195–0.205 mm., depth 0.059-0.063 mm., length 3.1 to 3.5 times the depth; telotarsus with flexor margin virtually straight, extensor margin weakly convex, length 0.15-0.17 mm., depth about 0.045 mm.; tarsal podomeres with numerous well-developed setae; tarsal claws simple, relatively small, fairly heavy; arolium long and extending beyond the tarsal claws. Fourth leg with chaetotaxy and color much as in the first leg; trochanter with flexor margin nearly straight, extensor margin highly arched, length about 0.3 mm., about one and one-third times the depth; pars basalis with flexor margin convex but weakly so in the distal portion, numerous setae on the flexor surface, length 0.24 mm., depth about 0.16 mm.; pars tibialis very stout, flexor margin evenly but weakly convex, extensor margin evenly convex except for an abrupt bending of the margin at the proximal-extensor corner, numerous long setae especially on the flexor surface, length about 0.63 mm., depth 0.355 mm.; entire femur with the flexor margin evenly convex and uninterrupted at the juncture of the pars basalis and pars tibialis; length of entire femur 0.72–0.735 mm., depth 0.355 mm.; tibia with evenly convex flexor margin; extensor margin nearly straight distal to the midpoint but a little convex proximal to the midpoint, deepest near the distal third, length 0.52–0.53 mm., depth 0.145 mm.; metatarsus subcylindrical, length 0.26–0.275 mm., depth about 0.082 mm.; telotarsus with flexor margin almost straight, extensor margin convex, length 0.205 mm., depth 0.061 mm.; setae very numerous on the tarsal podomeres; extensor surface of metatarsus with a long tactile seta about one-seventh or one-eighth of the podomere length from the proximal end and a pseudotactile seta just within the distal one-third of the podomere; telotarsus with three long pseudotactile setae, of which one is located about one-third and the other two about two-thirds of the podomere length from the proximal end; terminal claws and arolium as in the first leg.

Genital complex: Posterior operculum with two or more long submedial setae near the posterior margin and four others on the posterior edge of the genital aperture; anterior operculum with a row of two to four setae at each anterio-lateral corner of the genital aperture and two or three setae some distance anterior to each row.

FEMALE: Unknown.

TYPE LOCALITY: The male holotype in a collection from Mona Island, taken in February, 1914; the male paratype from Coamo Springs, Puerto Rico, in June, 1915. The latter individual belongs to the collection from which *P. puertoricensis*, new species, is described.

In Beier's key (1932) to the species of the genus *Pachyolpium*, *P. aureum* keys out to *P. crassichelatum* (Balzan, 1890), a species reported from south of the Amazon River in South America. Measurements of palpal podomeres, especially the length:width ratios of the femur and tibia, are very similar in the two forms. The femur of our species is much less stout, however, than that pictured by Beier (1932, fig. 224) for *P. crassichelatum*, which in turn does not agree with either the original description by Balzan or Beier's redescription. According to the original and later descriptions and figures given by Balzan (1890, pp. 439–440, figs. 20, 20a, 20b; 1891, p. 537, fig. 29) *P. aureum* seems to differ from *P. crassichelatum* in the following respects: the inner margin of the chelal hand is more flatly rounded and not so convex in the former; the inner margin of the palpal femur is nearly straight and not centrally bulging and convex as pictured for *P. crassichelatum;* palpal podomeres are finely granular on the medial surface, not smooth; and the longest flagellar seta is longer and more slender in our form with many more unilateral denticulations than shown by Balzan (1890, fig. 20b) for *P. crassichelatum*. Our form also resembles to some extent *P. furculiferum* (Balzan, 1891), but the palpal tibia is stouter, the chelal fingers are longer than the hand without the pedicle, and the inner surfaces of the palpal podomeres are finely granular in contrast to the smooth condition reported for *P. furculiferum* (*fide* Beier, 1932). Separation of *P. aureum*, new species, from *P. medium*, new species, is indicated in the key.

Pachyolpium puertoricensis, new species

Figures 5–8

MALE: Body moderately stout; abdomen and legs light yellow color, carapace slightly darker; palps yellow to yellowish brown with chela a little darker than more proximal podomeres; body length about 2 mm. Carapace nongranular; a few setae present; posterior carapacal margin nearly straight with four setae separated from the margin by a narrow unpigmented band; lateral margins weakly convex behind the eyes; carapace much narrowed before the eyes; anterior margin with a shallow median sinuation and a pair of submedial setae; another pair of setae near each latero-anterior corner of the carapace; the two eyes of each side subequal in size, separated from each other by about one-half the diameter of one eye; anterior eye of each pair removed from the anterior margin by between one and one-half and two times the diameter of the eye; length of carapace 0.52–0.57 mm.; greatest width near the posterior one-third and about 0.8 of the length; posterior width a little less than greatest width; ocular width 0.33–0.37 mm. Abdomen oval in shape, length 1.35–1.5 mm., width about one-half of the length; tergites weakly sclerotized, smooth; first tergite with four to six setae, second with six to eight; sternites also weakly sclerotic, pale yellow in color; a few of the anterior sternites faintly marked by net-like lines, sternite 4 with a medially placed row of six marginal setae and a lateral seta just medial to each stigmatic plate; number of setae on each sternite of the central part of the abdomen usually about 12; stigmatic plates asetaceous.

Chelicera: Fairly stout; yellow in color; the five basal setae long; flagellum of three setae, the longest forming a stout blade with six to eight (occasionally 10) heavy unilateral denticulations along the anterior margin of little more than the distal one-third; the other two setae subequal in length, each with a few weak and subterminal denticulations and little more than one-half the length of the first; length of chelicera 0.185–0.195 mm.; width of base 0.125–0.135 mm. Fixed finger curved; lamina exterior with an evenly convex outer margin; apical tooth little sclerotic, acute, with a minute denticle on the inner surface; distal half of inner margin of finger with five or six retroconical teeth; teeth of serrula interior as in the preceding species. Movable finger 0.175–0.18 mm. long; outer margin nearly straight to weakly convex; inner margin weakly concave; finger of nearly the same width throughout; serrula exterior of about 25 ligulate plates; apical tooth light brown in color, slender, acute, directed almost at a right angle to the longitudinal axis of the finger; subapical lobe conical in shape; galeal seta inserted near base of the subapical lobe and reaching about to the tip of the galea; galea slender with two weak and slender spine-like rami near the distal one-fourth.

Palpus: Moderately stout; surface smooth except for a very few minute granules on the inner surface of the hand at the base of the fingers in some individuals; surface polished in appearance, with numerous acuminate setae. Maxilla fairly stout; apical process with a terminal seta and two other long setae along the outer margin some distance from the tip; several setae on the smooth face of the maxilla; length 0.325–0.355 mm., about 1.8 times the width. Trochanter with evenly convex flexor margin, extensor margin straight to weakly convex; several long setae on the flexor surface; length 0.285–0.295 mm., about 1.8 times the width. Femur with pedicle much shorter than wide and symmetrically placed; extensor margin almost straight in central portion, weakly convex in the distal fourth; flexor margin with basal half weakly convex, distal half weakly concave; dorsal sensory seta within the basal one-third of the podomere; length 0.445–0.45 mm.; greatest width near the basal third, 0.165-0.17 mm.; length 2.6 to 2.7 times the width. Tibia with pedicle about as long as wide; outer margin more flatly convex in the proximal than in the distal half; inner margin bulging, proximal two-thirds weakly convex, distal one-third with a weak sinuation; length 0.5–0.51 mm.; width 0.21 mm. Chela from the dorsad with pedicle displaced far toward the outer side; outer margin evenly convex; inner margin slightly more convex than the outer; fingers moderately stout, gently curved; long acuminate setae fairly numerous; length of chela 0.795–0.82 mm.; width 0.305–0.325 mm.; length 2.5 to 2.6 times the width; length of hand without pedicle 0.4–0.425 mm.; depth of chela subequal to width; length of movable finger 0.415-0.435 mm. In lateral view, hand and fingers relatively stout; pedicle placed toward the ventral side; both dorsal and ventral margins weakly and somewhat flatly convex; movable finger with weakly concave inner margin, slightly convex outer margin; fixed finger with inner margin weakly convex, outer margin very weakly convex to virtually straight. Both chelal fingers with between 30 and 35 marginal teeth arranged along most of the margin; teeth at the very distal end of the row small and conical, those of the proximal part of the row flat and rounded. Tactile setae of movable finger with *t* about one-third of finger length from tip and *st* about one-third of finger length from base, *sb* nearly midway between base of finger and *st*, *b* about two areolar diameters proximal to *sb;* nodus ramosus somewhat distal to tactile seta *t*. Fixed finger with *et* about one-eighth of the finger length from tip, *est* slightly proximal to midpoint of finger; *it* distal to *est* and near or a little distal to the midpoint of finger, *ist* within about the basal third or fourth of the finger and on a level midway between the levels of *est* and *eb;* *ib* near base of finger on dorsal surface; *isb*, *esb*, and *eb* forming a row of three setae near the finger base, with *esb* on about the level of *ib;* nodus ramosus located proximal and a little closer to *et* than the latter is to the finger tip.

Legs: Smooth; acuminate setae more numerous on the tarsal podomeres than elsewhere. First leg with trochanter subtriangular, flexor margin evenly convex except near the pedicle, extensor margin nearly straight, length about 0.13 mm., depth 0.11–0.12 mm.; pars basalis with flexor margin weakly convex, extensor margin with a weak central concavity, length 0.235–0.245 mm., depth 0.088 mm.; pars tibialis about three-fifths as long as the pars basalis, extensor and flexor margins weakly convex, length 0.145–0.15 mm., depth 0.087–0.089 mm., length 1.6 to 1.75 times the depth; tibia with convex flexor margin, extensor margin with a weak concavity centered between the midpoint of the margin and the distal third, length about 0.21 mm., depth 0.06–0.065 mm.; metatarsus with weakly convex flexor margin, weakly concave extensor margin, slightly narrowed toward the distal end, length 0.148–0.157 mm., depth about 0.046 mm.; telotarsus with flexor margin nearly straight, length 0.13–0.15 mm., depth about 0.036 mm.; arolium extending well beyond the slender and simple terminal claws. Fourth leg: trochanter with nearly straight flexor margin, extensor margin very convex, length 0.21–0.225 mm., depth about 1.5 mm.; pars basalis with flexor margin convex and with numerous setae on the flexor surface, length 0.18–0.19 mm., length 1.5 to 1.6 times the depth; pars tibialis very stout, flexor margin moderately convex, extensor margin convex except at the very proximal end where the margin bends somewhat abruptly to meet the short extensor margin of the pars basalis, a few setae on both extensor and flexor surfaces, length 0.445–0.47 mm., depth 0.25–0.255 mm., length 1.78 to 1.87 times the depth; entire femur 0.52–0.55 mm. long, length 2.1 to 2.2 times the depth; tibia with moderately convex flexor margin, extensor margin weakly convex in the proximal part becoming almost straight in the distal portion, greatest depth near the distal third, length 0.385–0.4 mm., depth about 0.116 mm., length 3.35 to 3.45 times the depth; metatarsus with margins virtually straight to very weakly convex, slightly narrowed toward the distal end, the sensory seta on the extensor margin about one-eighth of podomere length from the basal margin, length about 0.215 mm., depth 0.065–0.07 mm., length 3.15 to 3.35 times the depth; telotarsus with flexor margin nearly straight, extensor margin irregularly convex and with pseudotactile setae, length 0.167–0.186 mm., depth 0.045–0.048 mm., length 3.5 to 4.05 times the depth; claws and arolium as in the first leg.

Genital complex: Posterior operculum with six well-spaced marginal setae behind the genital aperture and four to six setae on the very rim of the genital aperture, these latter forming two well-separated groups; anterior operculum with four to eight setae on the anterior rim of the aperture and a group of three scattered setae anterior and sublateral on each side of the aperture.

FEMALE: General appearance similar to that of the male except the body is larger, 2.3–2.6 mm. Carapace as in the male except larger and a little less elongate; length 0.63–0.67 mm.; width about 0.9 times the length; posterior width slightly less than greatest width; ocular width 0.4–0.44 mm. Abdomen 1.6–1.9 mm. long, width about one-half the length; other characteristics as in the male.

Chelicera: Length 0.22 mm.; width of base 0.15–0.165 mm.; movable finger 0.2–

0.21 mm. long; setae of base, the flagellum, and the fixed finger as in the male. Movable finger with galeal seta failing by a considerable distance to reach the tip of the galea; galea much larger than in the male, bifurcated near the distal one-fourth, with one of the rami secondarily bifurcated near its midpoint; all galeal rami well developed and gently curved; chelicera otherwise as in the opposite sex.

Palpus: Same general features as in the male but podomeres larger; maxilla 0.4 mm. long, length about twice the width; trochanter 0.32–0.34 mm. long, length about 1.8 times the width; femur length 0.525–0.53 mm., 2.7 times the width; tibia 0.59–0.6 mm. long, 2.4 times the width; chela length 0.96–1 mm., about 2.5 times the width; length of hand 0.53–0.56 mm.; movable finger 0.48–0.495 mm.; chela depth 0.38–0.4 mm. From the side, shape of hand and fingers, also position of tactile setae and nodi ramosi much as in the male. Teeth of the chelal fingers like those of the opposite sex except that there may be slightly more than 35 teeth on each finger.

Legs: Like those of the male with respect to shape, color, texture, and other general characteristics, but differing in size and sometimes in the length:depth ratios of podomeres. First leg with trochanter 0.14–0.155 mm. long, about 0.125 mm. deep; pars basalis 0.265–0.29 mm. long, length 2.8 to 2.9 times the depth; pars tibialis 0.16–0.17 mm. long, length 1.7 times the depth; tibia 0.235–0.25 mm. long, length between 3.4 and 3.6 times the depth; metatarsus about 0.17 mm. long, 0.05 mm. deep; telotarsus 0.135–0.15 mm. long, length 3.4 to 3.55 times the depth. Fourth leg: trochanter about 0.26 mm. long, length 1.6 to 1.65 times the depth; pars basalis 0.19–0.205 mm. long, depth about 0.137 mm.; pars tibialis 0.495–0.535 mm. long, depth 0.252 mm.; entire femur somewhat less stout than in the male, length 0.58–0.6 mm., depth 0.252 mm., length 2.3 to 2.45 times the depth; tibia 0.425–0.455 mm. long, length 3.6 to 3.75 times the depth; metatarsus 0.235–0.255 mm. long, about 3.4 times the depth; telotarsus about 0.18 mm. long, length 3.3 to 3.55 times the depth.

Genital complex: Posterior operculum with six well-spaced marginal setae; anterior operculum with six submedially placed setae.

TYPE LOCALITY: The male holotype, the female allotype, two male paratypes, and one female paratype in a collection made at Coamo Springs, Puerto Rico, between June 5 and 7, 1915.

In the same collection were found two tritonymphs and one protonymph, apparently belonging to the genus *Pachyolpium.* Since *P. aureum* as well as the present species was present in the collection, it seems inadvisable to describe or identify the nymphs.

Pachyolpium puertoricensis shows relationship to several *Pachyolpium* species in which the palpal podomeres are stout. Separation of these forms is possible, however, on the basis of shape and length: width ratios of palpal podomeres. *P. puertoricensis* is to some extent related to *P. adiposum* Hoff, 1945, from the Canal Zone but can be identified by the stouter tibia and the much longer chela. Relationship of the present species to *P. confundens*, new species, is given under the description of the latter.

Pachyolpium confundens, new species

Figures 9, 10

MALE: Body moderately stout; body and legs yellow; palps, especially chela, and carapace a little darker in color; length of body 1.8 mm. Carapace with nearly straight posterior margin, possibly two pairs of marginal setae; lateral margins evenly convex behind the eyes, carapace narrowed before the eyes; anterior margin relatively short with a weak median concavity, a pair of submedial setae, another seta just lateral to each anteriolateral corner; surface virtually smooth, few acuminate setae; eyes of each pair nearly equal in size, those of each side separated by about one-half of the diameter of the eye, the anterior eye of each side removed from the anterior margin by about one and one-half times the diameter of the eye; carapace 0.6 mm. long, greatest width 0.5 mm. near the center; posterior width 0.45 mm.; ocular width 0.385 mm. Abdomen stout, oval in shape; length 1.2 mm., width about 0.75 mm. Tergites smooth; the first tergite with four setae, the second with six setae; sternites smooth, the same color as tergites; fourth sternite with six setae evenly spaced along the central portion of the posterior margin and a single seta just medial to each posterior stigmatic plate; greatest number of setae on any one sternite about 12; stigmatic plates asetaceous.

Chelicera: Fairly stout; length 0.21 mm.; base smooth, width 0.15 mm.; five acuminate setae long; flagellum of three setae; other details not available. Fixed finger tapering toward the slender and somewhat sclerotic apical tooth; apical tooth with a minute denticle on the inner surface appearing continuous with the six retroconical teeth of the inner margin of the finger; lamina exterior wide; serrula interior very transparent, terminal tooth elongate and spine-like, others fused to form a velum. Movable finger 0.178 mm. long; outer margin weakly convex, inner margin weakly concave; apical tooth sclerotic, brown in color, somewhat acute and slender; subapical lobe conical, placed near the level of the base of the galea; inner margin of finger apparently with a minute denticle a short distance proximal to the subapical lobe; galeal seta inserted near base of the subapical lobe and nearly equal in length to the galea; serrula exterior of 22 ligulate plates; galea consisting of a straight stalk with two weak and spine-like subterminal denticles.

Palpus: Moderately stout; color varying from yellow on the proximal podomeres to yellowish brown on chela and fingers; surface smooth and polished. Maxilla smooth with a few acuminate setae; apical process with one apical seta and two setae near the center; length of maxilla 0.34 mm., width about 0.19 mm. Trochanter with both flexor and extensor margins convex; length 0.31 mm.; width 0.165 mm. Femur with tactile seta on the dorsal surface in the proximal one-third of the podomere; pedicle shorter than wide and displaced a little toward the extensor margin; flexor margin convex in the central part but nearly straight toward the distal end; numerous acuminate setae; greatest width near the midpoint; length 0.51 mm., width 0.175 mm., length 2.9 times the width. Tibia with outer margin flatly convex; inner margin angular near the distal third, margin proximal to this point flatly convex, distal to this point with a very weak concavity; surface with numerous acuminate setae; pedicle stout; length of tibia 0.545 mm., width 0.215 mm., length 2.53 times the width. Chela with outer margin weakly convex; inner margin well rounded; pedicle displaced toward the outer margin; fingers moderately stout and curved; chela smooth, with numerous acuminate setae; length of chela 0.905 mm., width 0.32 mm., length 2.83 times the width; hand without pedicle 0.44 mm. long; movable finger 0.465 mm. long. From the side, margins of hand weakly convex; hand about 0.28 mm. deep; fingers fairly stout, little curved; both fingers with a convex outer margin but inner margin nearly straight. Fixed finger with about 40 teeth, ranging from small conical teeth at the distal end to long and flat teeth at the proximal end of the row; movable finger with a few more than 40 teeth, these similar to the teeth of the opposing finger. Tactile setae of movable finger: *t* somewhat more than one-third of the finger length from the tip; *st* about one-third of finger length from the proximal margin; *sb* about midway between *st* and the proximal margin of the finger, *b* about two areolar diameters proximal to *sb;* nodus ramosus considerably closer to tactile seta *t* than to the finger tip. Fixed finger with *et* between one-fifth and one-sixth of the finger length from the tip, *est* about three-fifths of the finger length from the tip; *it* a little distal to the level of *est* and near the midpoint of the finger; *ist* a little farther from *it* than from the finger base; *isb*, *esb*, and *eb* forming a row of three setae on the external face near the finger base; *ib* located subdorsally at about the same level as *esb;* nodus ramosus proximal to the level of tactile seta *et*.

Legs: Yellow in color; smooth; setae more numerous on the tarsal podomeres than elsewhere. First leg with trochanter subtriangular, flexor margin moderately convex, extensor margin much less convex, length 0.15 mm., depth 0.123 mm.; pars basalis elongate, flexor margin irregularly and weakly convex, extensor surface weakly concave, deepest at the distal end, length 0.258 mm., depth 0.1 mm.; pars tibialis three-fifths as long as the pars basalis, both margins weakly convex, length 0.156 mm., depth 0.095 mm.; tibia with extensor margin weakly concave, flexor margin convex, length 0.21 mm., depth 0.07 mm.; metatarsus subcylindrical, length 0.16 mm., depth 0.055 mm.; telotarsus with flexor margin nearly straight, length 0.14 mm., depth 0.043 mm.; tarsal claws simple and relatively small, arolium extending for a short distance beyond the terminal claws. Fourth leg: pars basalis with evenly convex flexor margin, length 0.205 mm., depth 0.117 mm.; pars tibialis stout, flexor margin weakly convex, extensor margin convex especially at the proximal end, extensor surface almost asetaceous, length 0.475 mm., depth 0.245 mm.; entire femur 0.56 mm. long, length 2.3 times the depth; tibia very narrow at the proximal end, flexor margin evenly convex, extensor margin weakly convex in the proximal portion to slightly concave near the distal end, length 0.39 mm., depth 0.118 mm.; metatarsus with both margins very weakly convex, slightly narrowed toward the distal end, length 0.23 mm., depth 0.075 mm.; telotarsus with flexor margin straight, extensor margin convex, length 0.178 mm., depth 0.053 mm.; metatarsus with numerous long setae including a poorly developed tactile seta near the basal one-eighth of the extensor margin; telotarsus with numerous setae, those of the extensor surface especially long; tarsal claws and arolium as in the first leg.

Genital complex: Difficult to distinguish clearly in the holotype; probably similar to the genital complex of *P. puertoricensis.*

TYPE LOCALITY: The male holotype from a vial labeled "Dorodo sifting, San Juan, P. R., Feb. 11–14, 1914."

The present species is very similar to *P. puertoricensis* but may be recognized by the more slender and longer chela in *P. confundens.* Also, in *P. confundens* there are more teeth on the chelal fingers, and the pedicle of the palpal femur is displaced a little toward the outer margin so that the podomere appears less symmetrical than in *P. puertoricensis.*

Pachyolpium medium, new species

Figures 11–15

MALE: Body moderately stout; appendages moderately slender; abdomen and legs yellow in color, carapace and palps golden yellow; body length 2.25–2.4 mm. Carapace stout; surface smooth except for very small granules (best seen in profile) on the anterior half of the lateral surfaces of all individuals and a band of weak net-like markings near the posterior marginal setae and on the posterior part of the lateral margin in some individuals; posterior margin straight, with two pairs of marginal setae separated from the true margin by an unpigmented band; lateral margins convex; anterior margin short, with a very shallow median concavity and a pair of submedial setae; a seta near each anteriolateral corner; two pairs of well-developed eyes; eyes of each pair separated by less than one-half the diameter of an eye; the anterior eye removed from the anterior margin by a distance equal to, or slightly greater than, the longitudinal diameter of the eye; carapace narrowed in the region of the eyes; length of carapace 0.69–0.71 mm.; greatest width in the central part of the carapace and equal to 0.8 to 0.85 of the length; posterior width about 0.5 mm., somewhat less than the greatest width; ocular width 0.44–0.48 mm. Abdomen fairly stout; oval in shape; tergites and sternites weakly sclerotic, with very faint net-like surface markings; first tergite with four setae, second with six to eight; fourth sternite with four to six setae near the center of the posterior margin and one seta somewhat medial to each posterior stigmatic plate; maximum number of setae on any sternite usually about 10; length of abdomen 1.55–1.75 mm., about twice the width. Stigmatic plates asetaceous.

Chelicera: Fairly stout, yellow color, surface smooth; five setae present on base;

flagellum of three setae, the longest with numerous very fine denticulations along the distal half of the anterior margin, the middle seta little more than one-half as long as the longest, the shortest seta little less than one-half the length of the longest, each of the two short setae with two or three minute subterminal denticulations; length of chelicera 0.21–0.22 mm.; width of base 0.15–0.16 mm. Fixed finger distinctly curved near the base, distal portion less curved; outer margin of finger and outer margin of lamina exterior flatly convex; terminal tooth acute, a little sclerotic, bearing a small denticle on the inner margin; inner margin of finger with six or seven very flat, retroconical teeth arranged along the distal one-half of the finger margin; serrula interior with the distal tooth spine-like, other teeth fused into a velum. Movable finger with outer margin weakly convex, inner margin weakly concave; more or less constant in width throughout the distal three-fourths of the finger; apical tooth acute, sclerotic, brown in color; subapical lobe poorly developed and often bilobed; galeal seta inserted on a level with the base of the galea, not reaching to the tip of the galea; serrula exterior of 21 to 24 ligulate plates; galea with a long stalk-like basal portion, a ramus originating at about the distal one-fourth of the galea, another ramus slightly more distal; galeal rami simple and weak; length of movable finger 0.19–0.2 mm.

Palpus: Usually a golden yellow color throughout, some individuals lighter than others. Maxilla robust, laterally with a few scattered granules; apical process with a large apical and a large subapical seta, two or three smaller setae toward the base; length 0.43–0.46 mm., width 0.23–0.26 mm. Trochanter with margins rounded; a few small granules on the extensor-distal corner; numerous setae on the flexor surface; length 0.355–0.37 mm., width about 0.22 mm., length about 1.6 times the width. Femur relatively slender; pedicle wider than long and placed toward the extensor side; extensor margin virtually straight except near the ends; flexor margin very weakly convex; flexor surface with a very few, minute, and widely scattered granules; greatest width near the center; dorsal tactile seta well within the basal one-third of the podomere; length 0.61–0.63 mm., width 0.185–0.195 mm., length 3.2 to 3.4 times the width. Tibia with pedicle about as long as wide; extensor margin flatly convex in the basal two-thirds or three-fourths, more convex beyond; flexor margin flatly convex distal to the pedicle and proximal to the distal two-fifths, almost straight to weakly concave in the distal two-fifths; flexor surface with fewer granules than on femur, sometimes apparently smooth; length 0.62–0.63 mm., width 0.235–0.24 mm., length 2.6 to 2.7 times the width. Chela from dorsad not particularly stout; hand virtually smooth; extensor margin flatly convex in center; flexor margin more evenly convex; pedicle displaced toward the extensor side; finger fairly slender, evenly curved; length of chela 0.105 mm., width 0.348–0.367 mm.; length 2.9 to 3.05 times the width; length of hand without pedicle about 0.52 mm.; length of movable finger 0.57–0.60 mm. Chela from the side fairly stout; ventral margin flatly convex; dorsal margin more convex; pedicle displaced toward the ventral side; movable finger moderately slender, outer margin convex, inner very weakly to moderately and evenly concave; fixed finger slightly stouter, inner margin weakly convex, outer margin weakly convex to weakly concave; considerable variation in outline of the fingers as seen from the side; depth of hand about equal to width, 0.348–0.37 mm. Each chelal finger with between 45 and 50 contiguous teeth distributed along almost the entire finger margin; teeth much as in *P. aureum*, new species; each finger with a well-developed lamina defensor. Tactile setae of movable finger with *t* about one-fourth or slightly more of finger length from tip; *st* between one-third and four-ninths of the finger length from the base; *sb* usually a little farther from *st* than from the basal margin of the finger; *b* between two and three areolar diameters proximal to *sb;* nodus ramosus about two areolar diameters distal to tactile seta *t*. Fixed finger with *et* near the distal one-eighth of the finger length; *est* at, or slightly proximal to, the midpoint of the finger, about midway between *et* and *eb; it* usually on a level between one-seventh and one-sixth of the finger length distal to *est*, *ist* about the same distance proximal to the level of *est; isb*, *esb*, and *eb* forming a row near the base of the finger; *esb* and *eb* separated by about one areolar diameter, *isb* and *esb* separated by about two areolar diameters; *ib* between the levels of *isb* and *esb;* nodus ramosus nearly as far proximal to *et* as the latter is from the finger tip.

Legs: Moderately slender; smooth; yellow color; numerous setae on distal podomeres. First leg with trochanter subtriangular, external margin nearly straight, flexor margin convex, length 0.156–0.17 mm., about 1.25 times the depth; pars basalis elongate, extensor margin with a weak central concavity, flexor margin evenly convex, deepest near the distal end, length 0.29–0.3 mm., depth 0.1–0.11 mm.; pars tibialis little more than half as long as the pars basalis, both margins weakly convex, length 0.155–0.175 mm., depth 0.095–0.1 mm.; tibia with extensor margin very weakly to weakly concave, flexor margin weakly convex, deepest near the center, length about 0.26 mm., depth 0.072–0.079 mm.; metatarsus subcylindrical, slightly less deep toward the distal end, length 0.175–0.185 mm., 3.5 to 3.6 times the depth; telotarsus slender, length 0.136–0.145 mm., 3.8 to 3.9 times the depth; arolium extending slightly beyond the tips of the simple terminal claws. Fourth leg with trochanter and femur stout, other podomeres fairly slender; color yellow; trochanter with weakly convex flexor margin, extensor margin arched, length 0.24–0.25 mm., about 1.5 times the depth; pars basalis subtriangular, flexor margin very weakly convex except near the basal third, a few setae on the flexor surface, length 0.215–0.224 mm., 1.5 to 1.6 times the depth; pars tibialis very stout, flexor margin weakly convex, extensor margin very convex in the basal portion, length 0.525–0.545 mm., 1.75 to 1.85 times the depth; entire femur 0.61–0.625 mm. long, about 0.295 mm. deep; tibia with extensor margin weakly convex, flexor margin more convex, deepest near the distal third, length 0.445–0.46 mm., depth 0.122–0.13 mm., length 3.4 to 3.75 times the depth; metatarsus with both margins almost straight, deepest at the proximal end, tactile seta on extensor surface about one-seventh of the length of the podomere from the basal margin, length 0.235–0.245 mm., length 3.15 to 3.35 times the depth; telotarsus with flexor margin virtually straight, extensor margin weakly convex, numerous setae including a few pseudotactile setae on the extensor surface, length 0.177–0.186 mm., depth 0.05 mm.; claws and arolium as in the first leg.

Genital complex: Posterior operculum with six submarginal setae and two setae approximate to each posterio-lateral corner of the genital aperture; anterior operculum with seven to nine setae on the anterior rim of the aperture and six to eight longer setae anterior to the opening on the face of the operculum.

FEMALE: General characteristics as in the male except larger; length between 2.4 and 3 mm. Carapace about 0.8 mm. long, greatest width usually about 0.6 mm.; posterior width 0.5–0.6 mm.; ocular width 0.46–0.48 mm. Abdomen as in the male.

Chelicera: Differing but little from the chelicera of the male except for the larger size and the nature of the galea; length of chelicera 0.25–0.26 mm., width of base 0.165–0.18 mm.; usually 23 plates in the serrula exterior; galea trifid as in the male but basal portion and the three rami much stouter; galeal seta much shorter than the galea; movable finger usually 0.23 mm. long, may be as short as 0.215 mm.

Palpus: Shape of the podomeres and other general features much as in the male; maxilla 0.43–0.47 mm. in length, width 0.24–0.275 mm.; trochanter length 0.385–0.4 mm., length 1.7 to 1.8 times the width; femur 0.65–0.68 mm. long, length 3.05 to 3.3 times the width; tibia 0.64–0.675 mm. long, width 0.255–0.275 mm., length 2.45 to 2.5 times the width; chela 1.1–1.2 mm. long, 0.4–0.45 mm. wide, length 2.65 to 2.8 times the width; length of hand without pedicle 0.53–0.61 mm.; depth of hand a little less than width; length of movable finger 0.61–0.66 mm. Marginal teeth of chelal fingers, tactile setae, and nodi ramosi as in the male.

Legs: First leg like that of the male in general characteristics; trochanter 0.17–0.18 mm. long; pars basalis with length 0.305–0.315 mm., length equal to 2.65 to 2.85 times the depth; pars tibialis and tibia much as in the male; metatarsus 0.178–0.19 mm. in length, equal to 3.2 to 3.4 times the depth; telotarsus 0.14–0.155 mm. long, length 3.4 to 3.8 times the depth. Fourth leg essentially as in the male except femur conspicuously less stout and some podomeres considerably longer; trochanter 0.265–0.285 mm. long, length 1.4 to 1.6 times the depth; pars basalis as in the male; pars tibialis 0.545–0.575 mm. in length, depth 0.265–0.3 mm.; entire femur 0.64–0.67 mm. long, length 2.2 to 2.4 times the depth; tibia 0.46–0.48 mm. long, length 3.7 to 3.85 times the depth; metatarsus and telotarsus varying little from the condition in the male.

Genital complex (description based on allotype only): Simple; posterior operculum with six well-spaced submarginal setae in the central portion of the operculum; anterior operculum with six setae some distance from the female aperture; a pair of lateral and a median group of small cribiform plates.

TRITONYMPH: Much as in the adult but lighter color, less sclerotic, appendages somewhat stouter; body length 1.75 to 1.95 mm. Carapace with same general features as in the adult but smaller, eyes slightly farther removed from the anterior margin, fewer surface setae present, less granular on sides; length about 0.6 mm., width about three-fourths of the length, ocular width 0.34 mm. Abdomen smaller and with fewer setae than in the male; length about 1.2 mm., width one-half of the length.

Chelicera: Very similar to that of the female with the galea almost identical; number of plates in serrula exterior apparently a few less than in the adult; length of chelicera 0.17–0.19 mm.; width of base variable, between 0.12 and 0.135 mm.; length of movable finger 0.145–0.16 mm.

Palpus: General features as in the adult except smaller and podomeres stouter; color light yellow except for slightly darker chelal hand and fingers; convexities and concavities often more marked than the same features of the adult; shape of chelal fingers from the side variable; palps virtually smooth. Measurements as follows: trochanter 0.26–0.28 mm. in length, length about 1.7 times the width; femur 0.42–0.45 mm. long, equal to 2.8 to 2.95 times the width; length of tibia 0.39–0.42 mm., almost 2.2 times the width; chela 0.72–0.78 mm. in length, 2.65 to 2.75 times the width; length of hand without pedicle 0.35–0.4 mm.; depth of hand subequal to the width; length of movable finger about 0.42 mm. Marginal teeth of each chelal finger much as in the adult but cusps much more weakly developed and teeth of proximal end of each row may be somewhat rudimentary, between 30 and 35 teeth in the row on each finger; lamina defensor present. Movable finger with three tactile setae; *t* about one-third of length of finger from tip, *st* about one-third of finger length from base; *b* close to finger base; *sb* wanting; nodus ramosus somewhat closer to *t* than to the finger tip. Fixed finger with *et* near the distal one-sixth of the finger length; *est* about three-fifths of finger length from tip; *it* at about the midpoint of the finger; *ist* a little proximal to level of *est; esb* and *eb* near finger base and separated by about one areolar diameter; *ib* slightly distal to the level of *esb; isb* wanting; nodus ramosus no more than two areolar diameters proximal to *et*.

Legs: Similar to the legs of the adult except fewer setae and podomeres shorter; some podomeres stouter. First leg with pars basalis about 0.2 mm. long, length 2.5 to 2.6 times the depth; pars tibialis 0.12–0.14 mm. in length, depth 0.073–0.081 mm., length 1.6 to 1.75 times the depth; tibia 0.17–0.19 mm. long, about 3 times as long as wide; metatarsus 0.115–0.13 mm. long, width between 0.043 and 0.047 mm.; telotarsus more evenly tapering from proximal to distal end than in the adult, length 0.114–0.118 mm., depth 0.035–0.04 mm., length 2.95 to 3.25 times the depth; terminal claws and arolium much as in the adult. Fourth leg as in the female except podomeres smaller and fewer setae present; trochanter about 0.2 mm. long; pars basalis 0.155–0.17 mm. long; pars tibialis 0.36–0.405 mm. long, length about 1.9 times the depth; entire femur 0.43–0.48 mm. long, depth 0.186–0.216 mm., length 2.2 to 2.3 times the depth; tibia 0.315–0.345 mm. long, depth 0.085–0.1 mm.; metatarsus 0.165–0.18 mm. long, length 2.8 to 2.9 times the depth; telotarsus 0.14–0.16 mm. long, length 3.35 to 3.45 times the depth.

TYPE LOCALITY: The male holotype, female allotype, two male paratypes, three female paratypes, and two tritonymph paratypes in a collection made from Mona Island, West Indies, in February, 1914. Numerous individuals of *Novohorus suffuscus*, new species, belong to the same collection.

Pachyolpium medium shows relationships with several of the larger species of the genus. It is very closely related to *P. crassichelatum* from which it differs, however, in several ways: the juncture of the proximal and external margins of the chelal hand is rounded and not angular; the inner margin of the tibia is not evenly convex; the finger is longer than the hand without the base and about equal to the length of the hand with the base. From *P. arubense* our form may be separated by the more slender chela, the longer chelal finger, and the less well-defined femoral pedicle. Separation from *P. aureum* is easily carried out on the basis of differences indicated in the key.

NEOPACHYOLPIUM, NEW GENUS

DIAGNOSIS: Cephalothorax longer than wide, without cross furrows; each central tergite with 12–16 marginal setae; cheliceral flagellum with two setae; subapical lobe of cheliceral finger spine-like, long, acute, directed distad and subparallel to the apical tooth; palps moderately stout; palpal femur with a dorsal sensory seta near the base; tactile seta *est* near midpoint of fixed finger; *et* and *it* distal to *est; ist* a short distance proximal to *est;* pars tibialis of first leg shorter than pars basalis, the joint between the two femoral parts allowing free movement. A single species so far known.

GENOTYPE: *Neopachyolpium longum*, new species.

Neopachyolpium longum, new species

Figures 16–18

MALE: Body slender; abdomen and legs very light yellowish brown in color, carapace and palps light brown to reddish brown; length 2.3–2.5 mm. Carapace with weakly convex posterior margin bearing four to six submarginal setae separated from the posterior margin by an unpigmented band; lateral margin convex; anterior margin relatively short, with a shallow median concavity and a pair of submedial setae; dorsal face of carapace smooth, with numerous acuminate setae; anterior half of lateral surface with a few weakly developed granules, posterior half with net-like markings which extend to form a transverse band just anterior to the posterior marginal setae; two pairs of poorly developed eyes located not far from the anterior carapacal margin; length of carapace 0.63–0.7 mm.; greatest width near center and nearly three-fourths of the length; posterior width 0.37–0.43 mm.; ocular width about 0.35–0.37 mm. Abdomen slender; not very sclerotic; first tergite very wide, with net-like markings anterior to the six or eight marginal setae; second tergite with 10 setae and net-like markings as in the first tergite; other tergites virtually unsculptured; sternite 4 with weak net-like sculpturing and eight to 10 marginal setae in a row between the stigmatic plates, the seta of each end of the row close to the stigmatic plate; other sternites smooth and with a maximum number of about 14 setae; abdomen 1.75 mm. long; length about two and one-half times the width. Stigmatic plates asetaceous.

Chelicera: Base moderately stout; color light yellowish brown, smooth; five basal setae long and acuminate; flagellum of two blades, the anterior widened distally and with eight or nine acute denticulations confined to the distal third; the shorter flagellar seta spine-like with a length approximate to one-half the longer seta, apparently without subterminal denticulations; length of chelicera 0.21–0.22 mm., width of base 0.13–0.14 mm. Fixed finger well curved, lamina exterior relatively narrow; apical tooth acute, no more sclerotic than rest of finger; six to eight retroconical teeth along the distal half of the inner margin and the inner surface of the apical tooth; serrula interior with the distal tooth spine-like, rest of teeth fused into a velum. Movable finger 0.2–0.21 mm. long; moderately slender, little curved; outer margin virtually straight except near the ends; inner margin with two or three rudimentary teeth in the distal third; subapical lobe long, acute, extending subparallel to the apical tooth; apical tooth slender, long, acute, nearly the same color as rest of finger; galeal seta a little shorter than the galea and inserted near the base of the subapical lobe; serrula exterior of 21–23 ligulate plates; galea with stout basal portion, a lateral ramus about three-fifths of the galea length from the base, and a bifurcation just distal to the lateral branch; the three rami simple, long, acute, and little curved.

Palpus: Moderately stout; usually reddish brown; partly granular; setae numerous. Maxilla with granules on lateral surface, ventral face smooth; apical process with one long apical and one long subapical seta, other setae at the base; length of maxilla 0.34–0.38 mm. Trochanter with inner margin flatly convex; outer margin very irregularly convex; inner surface smooth and with numerous acuminate setae, outer surface with a few short setae and granules at the anterio-lateral corner; length about 0.34 mm., nearly twice the width. Femur with pedicle nearly as long as wide; inner margin with central portion evenly convex and with a weak concavity toward the distal end; outer margin very flatly convex; flexor surface with numerous well-developed granules, extensor surface smooth; dorsal tactile seta inserted about one-fourth of podomere length from the distal end; holotype 0.53 mm. long, 0.193 mm. wide; paratype 0.52 mm. long, 0.182 mm. wide. Tibia with inner surface granular; pedicle longer than wide; outer margin flatly convex in the basal three-fourths, more convex beyond; inner margin bulging near the center, flatly convex proximal to the bulge, concave distal to the bulge; length 0.52–0.56 mm., width 0.225–0.245 mm., length about 2.3 times the width. Chela from the dorsad fairly stout; pedicle displaced toward the outer side; widest near the base; hand usually angular in outline; inner margin weakly convex in center; outer margin very weakly convex; inner surface with a few granules (sometimes virtually smooth) especially toward the finger base; hand and fingers with numerous acuminate setae; fingers gently curved, fairly stout at base; holotype with chela length 0.94 mm., width 0.36 mm., length 2.6 times the width; paratype with chela 0.88 mm. long, width 0.31 mm., length 2.85 times the width; hand length 0.44–0.465 mm.; length of movable finger 0.49–0.51 mm. From the side, chelal hand subrectangular; greatest depth of 0.325–0.34 mm.; pedicle displaced far toward the ventral side; ventral margin very weakly convex in basal part but virtually straight in the distal part, dorsal margin weakly convex; fixed finger basally stout, tapering gradually toward the tip; inner margin of fixed finger weakly convex, outer margin weakly convex to straight; movable finger with inner margin weakly concave, outer margin convex; movable finger more slender than fixed finger. Fixed finger with between 40 and 45 contiguous teeth, varying from small, conical, and symmetrical at the distal end of the row to much wider, flatter teeth with poorly developed cusps at the basal end of the row; teeth of movable finger similar in number and shape; nodus ramosus of movable finger distal to tactile seta *t* by about one-fourth of distance from *t* to finger tip; in fixed finger, nodus ramosus about as far proximal to tactile seta *et* as *et* is from the finger tip; lamina defensor on each finger. Movable finger with four tactile setae: *t* one-fourth of finger length or more from the tip of the finger; *st* somewhat farther from *t* than latter is from the finger tip; *sb* about one-fifth of finger length from base; *b* nearly midway between finger base and *sb*. Fixed finger with eight tactile setae: *et* about one-eighth or less of finger length from tip; *est* just distal to midpoint of finger; *it* a little distal to *est; ist* somewhat proximal to the midpoint of the finger; *isb, esb,* and *eb* forming a row on the outer surface of the finger base; *esb* between two and three areolar diameters distal to *eb, isb* about the same distance distal to *esb; ib* subdorsally located on nearly a level with *eb.*

Legs: First leg fairly slender, fourth leg stouter; smooth; yellow color; acuminate setae numerous especially on the distal podomere; terminal claws slender, curved, acute; arolium simple, extending but little beyond the tips of the terminal claws. First leg with trochanter subtriangular, inner margin convex, outer margin very short, length about 0.15 mm., depth about 0.12 mm.; pars basalis elongated, flexor margin weakly convex, extensor margin with a weak concavity near the center, widest near the distal end, length 0.27–0.285 mm., 3.1 times the depth; pars tibialis slightly less than two-thirds as long as the pars basalis and almost as deep, both margins weakly convex, length 0.17–0.18 mm., twice the depth; tibia with extensor margin straight to very weakly convex or concave, flexor margin evenly convex, deepest distal to the center, length 0.25–0.26 mm., 3.55 times the depth; metatarsus subcylindrical, setae numerous and heavy, length about 0.177 mm., depth 0.05–0.052 mm.; telotarsus with flexor margin almost straight, extensor margin distally convex, setae very numerous and heavy (some are spine-like), length 0.15 mm., depth about 0.042 mm. Fourth leg somewhat stouter than the first; trochanter with very weakly convex flexor margin, extensor margin highly arched, length about 0.24 mm., 1.5 times the depth; pars basalis with evenly convex flexor margin, a few setae on the flexor surface, length 0.175–0.19 mm., between 1.4 and 1.5 times the depth; pars tibialis stout, flexor margin evenly convex and continuous with the flexor margin of the pars basalis, extensor margin much more convex especially in the proximal portion, length 0.43–0.475 mm., about twice the depth; holotype with entire femur 0.56 mm. long, depth 0.24 mm.; paratype with entire femur 0.52 mm. long, 0.213 mm. deep; tibia with both margins convex, the flexor much more so than the extensor, deepest distal to the midpoint, very much narrowed at the proximal end, setae fairly numerous, length 0.4–0.425 mm., 3.7 to 3.8 times the depth; metatarsus with both margins very weakly convex, setae numerous, length 0.235–0.24 mm., depth 0.065–0.07 mm., length 3.4 to 3.55 times the depth; proximal tactile seta of metatarsus relatively short and located about one-sixth of the podomere length from the proximal end; telotarsus with straight flexor margin, setae numerous, three very long and stout setae on the extensor surface, length 0.17–0.175 mm., length 3.3 to 3.45 times the depth.

Genital complex: Posterior operculum with eight irregularly arranged and well-separated setae probably representing the marginal row, two pairs of smaller setae on the posterior rim of the aperture; about eight setae clustered together just anterior to the aperture with seven to nine widely spaced setae on the face of the anterior operculum.

FEMALE: In general like the male except longer; length of body 2.6–2.8 mm. Carapace almost identical in the two sexes except larger in the female; length 0.7–0.75 mm.; greatest width 0.55–0.6 mm.; posterior width 0.45–0.55 mm.; ocular width 0.42–0.45 mm. Abdomen stouter than in the male, averaging about 2 mm. long and slightly less than 1 mm. wide.

Chelicera: Very similar to that of the male except a somewhat larger size and slight differences in the galea; length of chelicera 0.24–0.25 mm., width of base 0.15–0.17 mm.; movable finger 0.215–0.23 mm. long; galea stouter than in the male, lateral ramus near the midpoint, bifurcation a little distal to the midpoint; the three galeal rami longer than in the male.

Palpus: Very much like the palpus of the male except larger; maxilla about 0.39 mm. long, length 1.7 to 1.8 times the width; trochanter about 0.39 mm. long, length 2.05 to 2.15 times the width; femur 0.59–0.605 mm. long, length 2.95 to 3.05 times the width; tibia equal in length to femur, length 2.35 to 2.45 times the width; chela 1–1.05 mm. long, width 0.37–0.39

mm., length 2.7 to 2.8 times the width; hand without pedicle about 0.55 mm. long; movable finger about 0.53 mm. long. From the side, the chelal hand with fingers, teeth, nodi ramosi, and tactile setae much as in the male.

Legs: Much like those of the male but slightly longer. First leg with trochanter 0.16–0.17 mm. long; pars basalis 0.305–0.315 mm. long, about 0.1 mm. deep; pars tibialis 0.195–0.2 mm. long, depth 0.095 mm.; tibia 0.275–0.285 mm. long, length 3.65 to 3.75 times the depth; metatarsus 0.185–0.2 mm. in length, depth 0.053–0.055 mm.; telotarsus 0.155 mm. long, 0.042 mm. deep. Fourth leg with trochanter about 0.27 mm. long, length about 1.8 times the depth; pars basalis 0.19–0.2 mm. long, 0.12–0.13 mm. deep; pars tibialis about 0.5 mm. long, length 2.15 to 2.2 times the depth; entire femur about 0.6 mm. long, depth 0.226–0.235 mm.; tibia 0.46–0.47 mm. long, length 3.85 to 4 times the depth; metatarsus 0.255–0.265 mm. in length, 3.6 to 3.7 times the depth; telotarsus 0.178–0.185 mm. long, depth 0.053–0.057 mm.

Genital complex: Posterior operculum with six well-spaced marginal setae; anterior operculum with six to eight very weak, short, irregularly placed setae anterior to the aperture; lateral cribiform plates of moderate size, median plates apparently represented by a cluster of possibly six or eight very small plates.

TRITONYMPH: Moderately slender; 2 to 2.3 mm. long; body except for chelal hand and fingers light yellow in color, little sclerotic, chelal hand and fingers slightly brownish. Carapace virtually without net-like surface markings and with only a few granules; length about 0.6 mm., greatest width anterior to the center and between 0.4–0.5 mm.; posterior width not much less than the greatest width; ocular width 0.32 mm. Abdomen much as in the adult except lighter color, more weakly sclerotic, fewer setae, and smaller; length 1.5–1.75 mm., length about twice the width.

Chelicera: Much like the adult in general outline but smaller in size and differing in some details. Anterior flagellar blade more slender; length of chelicera 0.18–0.19 mm., width of base 0.125–0.129 mm. Movable finger 0.17–0.18 mm. long; galea much as in the female; serrula exterior with about 18 or 19 ligulate plates.

Palpus: Similar in general characteristics to the male; yellow color with chelal finger slightly darker, less sclerotic, granules less numerous and weaker; podomeres smaller; maxilla 0.32 mm. long, length about 1.85 times the width; trochanter 0.285 mm. long, about 2.05 times the width; femur 0.45 mm. in length, length 2.9 to 3 times the width; tibia equal to femur in length, about 2.4 times longer than wide; chela from the dorsad much like that of the male except smaller, not so angular, and virtually smooth; chela length 0.77 mm., width 0.255–0.27 mm.; hand length 0.38–0.4 mm.; movable finger 0.395–0.405 mm. long. From the side, chela similar to that of the adult except smaller, basal margin much more rounded, and hand less angular; depth of hand 0.25 mm. Each finger with between 30 and 35 teeth, similar in shape to those of the adult; nodus ramosus of each finger placed much as in the adult. Movable finger with three tactile setae: *t* and *st* as in the adult; *b* about one-sixth of finger length from base; *sb* wanting. Seven tactile setae on fixed finger: *et*, *est*, *it*, and *ist* much as in the adult; *esb* and *eb* near finger base and separated by between two and three areolar diameters; *ib* on nearly a level with *eb; isb* missing.

Legs: General structure much as in the male except the podomeres are shorter and often stouter. First leg with trochanter about 0.13 mm. long, 0.1 mm. deep; pars basalis 0.23 mm. long, depth 0.08 mm.; pars tibialis 0.14–0.15 mm. in length, depth 0.076–0.08 mm.; tibia with extensor margin weakly concave, length 0.195 mm., depth 0.062–0.065 mm.; metatarsus with extensor margin weakly concave, flexor margin weakly convex, length 0.14 mm., depth 0.05–0.053 mm.; telotarsus 0.125 mm. or slightly less in length, about 0.04 mm. in depth. Fourth leg with trochanter about 0.2 mm. long, about 0.125 mm. deep; pars basalis with the distal two-thirds of the flexor margin very weakly convex, length 0.148–0.155 mm., length 1.45 times the depth; pars tibialis with flexor margin very weakly convex, length 0.375 mm., depth about 0.175 mm.; entire femur 0.44–0.455 mm. long, length 2.55 to 2.6 times the depth; tibia with extensor margin almost straight, length 0.32–0.34 mm., about 3.7 times the depth; metatarsus about 0.195 mm. long, length 3.05 times the depth; telotarsus 0.135–0.14 mm. long, length 2.8 times the depth.

TYPE LOCALITY: The male holotype, one male paratype, the female allotype, the female paratype, and two tritonymph paratypes in collections made by Dr. A. H. Strickland from surface litter in a cacao estate at St. Augustine, Trinidad, British West Indies, between November, 1943, and February, 1944.

INDOLPIUM, NEW GENUS

DIAGNOSIS: Carapace longer than wide, four eyes; each central tergite with four marginal setae; subapical lobe of cheliceral finger simple; each palpal femur with two dorsal and well-separated tactile setae; fixed chelal finger with at least the tactile setae *it* and *et* on distal half of finger; with *est* near the midpoint of the finger, *it* much anterior to *est;* first leg with length of pars tibialis subequal to length of pars basalis; related to the genus *Xenolpium;* a single species reported from French Indo-China.

GENOTYPE: *Xenolpium funebrum* Redikortzev, 1938.

While the original species description given by Redikortzev for *Xenolpium funebrum* is somewhat meager and incomplete, it seems advisable to establish without further delay a new genus with *X. funebrum* as the type. Separation of the present genus from *Xenolpium* is indicated in the key. Unfortunately neither Redikortzev's description nor drawing indicates the position of the tactile setae of the chelal fingers or the nature of the subapical lobe of the cheliceral finger in the genotype. However, since Redikortzev assigned his individuals to the well-defined genus *Xenolpium*, it may be assumed that the position of the tactile setae of the chelal fingers and the nature of the subapical cheliceral lobe are identical in *Xenolpium* and *Indolpium*.

NOVOHORUS, NEW GENUS

DIAGNOSIS: Carapace a little longer than wide, with four eyes; central tergites with four marginal setae; femur with two long tactile setae, widely separated, with poorly developed areoles; tactile seta *it* of the fixed finger near the midpoint of the finger and slightly distal to the level of *est*, *ist* near base of finger and associated with the four basal setae; subapical lobe of the movable cheliceral finger divided; pars tibialis of the first leg slightly longer than the pars basalis.

GENOTYPE: *Novohorus suffuscus*, new species.

The new genus *Novohorus* is very closely related to the African genus *Horus*. The two genera may be separated easily by characteristics given in the key. As far as known, *Horus* is confined to Africa, and *Novohorus* is reported only from the West Indies.

Novohorus suffuscus, new species

Figures 19–26

MALE: Body with abdomen and legs yellowish brown, palps and carapace darker, often golden in color; body length 2.2–2.4 mm. Carapace with posterior margin straight or a little convex, one pair of setae removed from the posterior margin by a narrow unpigmented band; lateral margins well rounded; anterior margin relatively short, with a shallow median concavity dividing the margin into two weakly convex lobes; anterior margin with a pair of submedial setae and one seta at each rounded anterio-lateral corner; face of carapace with extremely weak net-like markings on the posterior half; on the sides, carapace somewhat roughened, often with weak granules in the anterior half; eyes well developed, the anterior of each pair separated from the anterior carapacal margin by much less than the greatest diameter of the eye; anterior eye of each pair larger, often much larger, than the posterior eye; eyes of each pair little separated; surface setae sparse; length of carapace 0.64–0.72 mm., greatest width near center 0.54 mm.; posterior width 0.45–0.48 mm.; ocular width 0.37–0.38 mm. Abdomen elongate, suboval in outline, length 1.55–1.65 mm.; width in most individuals about twice the length; tergites smooth, increasingly sclerotic and darker in color from the anterior to the posterior part of the abdomen; the first tergite with a pair of submedial setae; the second tergite with one or two setae; anterior three or four sternites and the tenth show weakly sculptured net-like lines; setae of sternites weak, usually six in each central sternite; sternite 4 with a submedial pair and a single seta just medial to each stigma. Stigmatic plates asetaceous.

Chelicera: Moderately stout; five basal setae long and acuminate; flagellum of three smooth setae, the anteriormost one long, blade-like, and terminally acute; the center flagellar seta a little longer than one-half the length of the longest, the proximal seta shorter than one-half of the length of the longest; chelicera 0.195–0.21 mm. long, base 0.125–0.135 mm. wide. Fixed cheliceral finger evenly and gently curved; lamina exterior present; serrula interior with the distal plate spine-like, others more or less fused into a velum; apical tooth of finger dark brown, sclerotic; about six retroconical teeth along the inner surface of the apical tooth and the distal half of the finger, each of the second and third teeth from the distal end of the row has two transversely placed cusps. Movable finger 0.15–0.165 mm. long; exterior margin evenly convex, inner margin evenly concave; apical tooth stout, short, dark in color, very sclerotic; subapical lobe located very close to the apical tooth and divided into two or three cusps or lobes; galeal seta inserted on a level with the subapical lobe, length subequal to that of the galea; serrula exterior with 17 to 20 ligulate plates; galea stout, a little curved, ending in three short, subterminal rami.

Palpus: Fairly stout; golden color; surface mostly non-granulate. Maxilla fairly stout; each apical process with a long apical seta, two long subapical setae (one lateral, one medial), and one or more small basal setae; setae sparse; maxilla marked laterally with weak net-like sculpturing; length 0.36–0.38 mm., width 0.21–0.215 mm. Trochanter with outer margin beyond pedicle convex and with a sublateral protuberance marked by a number of surface granulations; inner margin more weakly convex; a few long setae; length of trochanter 0.3–0.325 mm., length 1.65 to 1.8 times the width. Femur with pedicle wider than long and placed toward the inner side; inner margin convex in the basal two-thirds, slightly concave beyond; extensor margin convex, the central portion flattened; a few granules may be seen in relief along the convexity of the inner margin; two sensory setae, one within the basal fourth of the podomere and relatively short, the other much longer and placed usually between one-third and two-fifths of the podomere length from the distal end, the areoles of both setae relatively small; length of femur 0.485–0.545 mm., width 0.185–0.205 mm., length 2.5 to 2.65 times the width. Tibia virtually smooth; few long setae; pedicle about as long as wide; outer margin flatly convex; inner margin beyond pedicle evenly convex, in some individuals much flattened in the distal fourth; length equal to the length of the femur, width 0.2–0.235 mm., length 2.25 to 2.4 times the width. Chela from the dorsad with outer margin weakly convex; inner margin moderately convex especially toward the basal margin; pedicle near center of proximal margin of hand; setae not numerous, especially long near the hand base; hand fairly wide near finger base and slightly granular on the inner surface; fingers moderately slender, well curved; setae much more numerous on the fingers than on the hand; length of chela 0.85–0.92 mm., width 0.28–0.30 mm., length 2.85 to 3.05 times the width; hand without pedicle 0.415–0.46 mm. long, depth 0.26–0.29 mm.; movable finger longer than length of hand with pedicle, 0.47–0.49 mm. From the side, the chela is usually subrectangular in appearance; dorsal margin evenly and moderately convex; ventral margin very flatly convex; pedicle placed slightly toward the ventral side of the base; fixed finger with outer margin straight to very weakly convex; inner margin variable; movable finger with outer margin distinctly convex, inner margin at least weakly concave. Each finger with 30 to 35 teeth extending along nearly the entire finger margin; teeth contiguous, varying from acute and slightly retroconical at the distal end of the row to much flattened at the proximal end; each finger with a weakly developed lamina defensor; nodi ramosi very poorly developed and difficult to observe; nodus ramosus of fixed finger somewhat nearer to the tactile seta *et* than to the finger tip, that of movable finger removed from the finger tip by about one-third of the distance from the finger tip to tactile seta *t*. Movable finger with four tactile setae: *t* slightly more than one-third of the finger length from the tip; *st* about one-third of finger length from the base; *sb* somewhat nearer *st* than the distal finger margin; *b* two or three areolar diameters proximal to *sb*. Fixed finger with *et* near the distal one-fifth of the finger; *it* at or just distal to the midpoint of the finger; *est* slightly proximal to the midpoint of the finger and about three areolar diameters proximal to the level of *it; eb* near base of finger, *esb* about one areolar diameter distal to *eb, isb* about two areolar diameters distal to *esb; ib* on nearly the same level as *eb; ist* nearly on the level of *isb* but on the inner rather than the outer surface of the finger.[1]

Legs: Fairly stout; light in color; smooth; setae weak, poorly developed, sparse except on tarsal podomeres; tarsal claws simple; arolium undivided, extending for nearly one-half its length beyond the tarsal claws; legs show considerable variation. First leg with trochanter about as deep as long, length 0.105–0.11 mm.; pars basalis with convex flexor margin, outer margin little convex, length 0.155–0.18 mm., length 1.35 to 1.65 times the depth; pars tibialis equal to, or a little longer than, the pars basalis, both margins weakly and evenly convex, deepest near the center, length 0.16–0.185 mm., depth 0.11–0.115 mm.; tibia with extensor margin flatly convex, deepest in the distal fourth, length 0.21–0.24 mm., depth 0.73–0.78 mm., length 2.8 to 3.15 times the depth; metatarsus subcylindrical, short and stout, both margins weakly convex to virtually straight, length 0.075–0.095 mm., depth 0.05–0.06 mm.; telotarsus with flexor margin straight to weakly convex, about 0.1 mm. long, length 2.2 to 2.35 times the depth. Fourth leg with trochanter about 0.19 mm. long, length 1.25 to 1.4 times the depth, flexor margin nearly straight, extensor margin arched and much convex; pars basalis with the proximal one-third of the flexor margin convex, length about 0.19 mm., 1.35 to 1.45 times the depth; pars tibialis with extensor margin more or less evenly convex and arched, flexor margin almost straight proximally but distally convex, length 0.4–0.45 mm., depth 0.24–0.255 mm., length 1.6 to 1.9 times the depth; entire femur 0.53–0.57 mm. long, 2.2 to 2.25 times the depth; tibia with flexor margin evenly convex, outer margin more flatly convex, greatest depth near the distal one-third, length 0.365–0.4 mm., length 2.8 to 3.1 times the depth; metatarsus subcylindrical, slightly narrowed distally, length 0.13–0.14 mm., 1.7 to 1.75 times the depth; long sensory seta of metatarsus located usually about one-sixth of the podomere length from the basal margin; telotarsus with two long setae distal to the center of the extensor surface, length 0.13–0.14 mm., depth 0.06–0.067 mm., length 2.1 to 2.25 times the depth.

Genital complex: Two pairs of setae submedial in position on the face of the posterior operculum and two setae on each posterio-lateral corner of the rim of the genital aperture, numerous small slit-like lyrifissures just posterior to the genital aperture. Anterior operculum with a group of three (rarely two or four) setae just anterior to, and to each side of, the genital aperture.

Female: General features as in the male except for larger size and stouter palps; body length 2.9–3.1 mm. Carapace with sides less roughened and granular than in the male; length 0.75–0.77 mm., width 0.61 mm.; posterior width 0.56 mm.; ocular width 0.43–0.46 mm.; otherwise as in the male. Abdomen as in the male;

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[1] Considering the arrangement of the tactile setae in many genera of Olpiinae, it seems probable that in *Novohorus isb* has become through migration associated with *esb* and *eb* on the external face of the finger while *ist* has been retained on the inner surface of the finger in association with *ib*. This is contrary, however, to the condition indicated by Chamberlin (1931, fig. 37-F) *for Horus modestus in which ist* is shown associated with *esb* and *eb* on the external face of the finger.

length 2.15–2.35 mm., slightly more than twice the width.

Chelicera: Much as in the male; 0.21–0.22 mm. long, base 0.15–0.16 mm. wide; movable finger 0.17–0.18 mm. in length; galea larger with the rami longer and more conspicuous than in the male; galeal seta relatively much shorter than the galea.

Palpus: Much like that of the male except podomeres slightly longer and usually stouter; inner margin of chela typically more convex and swollen and hand wider than in the male; maxilla about 0.4 mm. long, length 1.7 times the width; trochanter 0.325–0.5 mm. long, width 0.2 mm.; femur 0.53–0.55 mm. long, width 0.22–0.235 mm., length 2.35 to 2.5 times the width; tibia nearly equal in length to the femur, width 0.245–0.265 mm., length 2.05 to 2.25 times the width; chela 0.975–0.98 mm. long, usually about 0.37 mm. wide with length usually 2.6 to 2.65 times the width (one paratype, probably atypical, with chela 0.32 mm. wide, length 3.04 times the width); chelal hand without pedicle 0.465–0.48 mm. long, chelal depth a little less than width and between 0.305 and 0.32 mm.; movable finger 0.51–0.545 mm. long. Teeth, tactile setae, and nodi ramosi of chelal fingers as in the male.

Legs: Like those of the male in general characteristics but a little larger. First leg: trochanter about 0.14 mm. long, 0.11–0.115 mm. deep; pars basalis about 0.183 mm. long, depth 0.117–0.125 mm.; pars tibialis 0.185–0.19 mm. long, 0.12–0.13 mm. deep, length about 1.5 times the depth; tibia 0.24–0.255 mm. long, 0.8–0.9 mm. deep, length 2.7 to 3.05 times the depth; metatarsus 0.085–0.1 mm., length 1.4 to 1.75 times the depth; telotarsus 0.108–0.114 mm., length 1.95 to 2.15 times the depth. Fourth leg much as in the male; trochanter 0.22–0.23 mm. long, length 1.35 to 1.5 times the depth; pars basalis 0.21–0.22 mm. long, length 1.4 to 1.5 times the depth; pars tibialis about 0.52 mm. long, depth 0.253–0.266 mm.; entire femur 0.615–0.64 mm. long, length 2.35 to 2.45 times the depth; tibia 0.4–0.41 mm. long, length 2.95 to 3.25 times the depth; metatarsus about 0.15 mm. long, 0.084–0.088 mm. deep, length 1.7 to 1.8 times the depth; telotarsus 0.145–0.155 mm. long, depth 0.071–0.076 mm., length 1.9 to 2.15 times the depth.

Genital complex: Posterior operculum with four to six well-spaced setae, anterior operculum with the same number; cribiform plates of the median pair appear to be larger than those of the lateral pair.

TRITONYMPH: Less sclerotic, lighter in color, and with many pedal podomeres stouter than in the adult; body length of one tritonymph 2.1 mm., of the other 2.45 mm. Carapace smooth, length 0.56–0.58 mm., greatest width 0.39–0.43 mm., posterior width little less than the greatest width, ocular width 0.31–0.32 mm. Abdomen 1.55–1.9 mm. long, length at least twice the width.

Chelicera: Very similar to that of the adult; 0.17–0.18 mm. long, base 0.125 mm. wide; movable finger 0.135–0.14 mm. long; galea much as in the female with galeal seta relatively short; 15 to 17 plates in the serrula exterior.

Palpus: In general outline much like the adult; podomeres smaller and areoles of the femoral tactile setae relatively more conspicuous than in the adult; from the side, chelal fingers conspicuously curved. Actual lengths of podomeres almost identical in the two tritonymphs but widths and length: width ratios of some podomeres differ considerably; maxilla 0.3 mm. long, 0.19 mm. wide; trochanter about 0.25 mm. long, width about 0.146 mm.; femur 0.4–0.41 mm. long, widths in the two tritonymphs 0.155 mm. and 0.175 mm., length 2.58 and 2.37 times the width, respectively; tibia 0.385 mm. and 0.39 mm. long, width 0.183 mm. and 0.201 mm., respectively; chela about 0.74 mm. long, widths in two specimens 0.216 and 0.278 mm., lengths 3.32 and 2.67 times the width, respectively; depth of chela subequal to the hand width; hand without pedicle 0.35–0.36 mm. long; fingers slightly longer than hand without pedicle. Teeth of chelal fingers as in the adult except only 20 to 25 in number. Tactile setae of movable finger very similar to those of the adult except *t* is somewhat more proximal in position and either *sb* or *b* is wanting. Fixed finger with tactile setae much as in the adult except *et* is placed a little more proximal, and *isb* is wanting.

Legs: Much as in the adult except podomeres shorter and often a little stouter. First leg with pars basalis 0.145 mm. long, length about 1.35 times the depth; pars tibialis equal in length to pars basalis, length about 1.35 times the depth; tibia 0.175–0.185 mm. long, length 2.5 to 2.6 times the depth; metatarsus 0.068 mm. in length, depth 0.054 mm.; telotarsus 0.093–0.098 mm., depth 0.05 mm. Fourth leg: trochanter of one paratype 0.155 mm. long and 0.13 mm. deep, of the other 0.175 mm. long and 0.125 mm. deep; pars basalis about 0.17 mm. long, length 1.4 times the depth; pars tibialis 0.38–0.395 mm. long, length about 1.85 times the depth; entire femur 0.465 mm. long, length 2.15 to 2.3 times the depth; tibia 0.29 mm. and 0.305 mm. long, 0.107 mm. and 0.118 mm. deep, respectively; metatarsus about 0.11 mm. long, length 1.45 and 1.55 times the depth; telotarsus 0.114 mm. and 0.12 mm. long, length 1.85 times the depth.

TYPE LOCALITY: The male holotype, three male paratypes, the female allotype, two female paratypes, and two tritonymphs in a collection made during the period of February 21 to 26, 1914, on Mona Island, West Indies.

LOCALITY RECORD: A single male in a collection bearing no date and made on Mona Island.

The relationship of *N. suffuscus* to *N. cinereus*, new species, is given under the description of the latter.

Novohorus cinereus, new species

Figures 27–29

MALE: Body, especially the abdomen, slender; legs and palps moderately stout; body longer than palps; abdomen and legs yellow in color, carapace and palps with a gray tinge; body length 1.85 mm. Carapace with two marginal setae separated from the weakly convex posterior margin by an unpigmented band; lateral margins weakly convex in the anterior half, nearly straight in the posterior half and marked by net-like lines; anterior margin with a weakly developed median concavity, a pair of sublateral setae, and a seta at each anterio-lateral corner; surface of carapace non-granulate, setae sparse; the eyes of the anterior pair a little larger than those of the posterior pair, the anterior eyes separated from the anterior carapacal margin by about one-half of the longitudinal diameter of the eye, the eyes of each pair approximate, with a long seta originating in the narrow interocular space; carapace widest near the center; length 0.5 mm., width about three-fourths of the length; posterior width subequal to the greatest width; ocular width 0.26 mm. Abdomen slender, nearly 1.35 mm. long, length about 2.4 times the width; first three tergites each with a single pair of setae, others with two pairs; tergites very wide; sternites much like tergites but three pairs of setae in each central and posterior sternite; fourth sternite with one or two pairs of setae and, in addition, a seta just medial to each stigmatic plate; stigmatic plates asetaceous.

Chelicera: Moderately stout; silk gland ducts conspicuous in base and finger; the five basal setae long and acuminate; yellowish in color; flagellum of three simple blades much as in the preceding species; width of base 0.09 mm.; length of chelicera 0.15 mm. Fixed finger weakly curved; lamina exterior conspicuous; apical tooth poorly differentiated, little sclerotic, not darker in color than remainder of finger; concave surface of the apical tooth with two subconical denticles continuous with three larger and retroconical denticles arranged along less than the distal half of the finger margin; serrula interior with a spine-like distal plate, remainder of plates more or less fused into a velum. Movable finger 0.118 mm. long; external margin nearly straight, internal margin very weakly convex except at the base; apical tooth short, little sclerotic, light brownish in color at very tip; subapical lobe very near base of apical tooth and with the distal division larger than the basal; serrula exterior apparently of 16 plates; galeal seta shorter than the galea, located near the level of the base of the galea; galea relatively stout, with fairly straight basal portion, trifid a little distal to the midpoint;

rami of galea simple, little curved, terminally acute.

Palpus: Moderately stout; setae fairly numerous, relatively long; surface smooth except for a very few granules on the inner margin of the hand near the finger base. Maxilla smooth, with few setae; apical process with a long apical seta, two subapical setae, and one or two other setae near the base; length of maxilla 0.235 mm., width about 0.14 mm. Trochanter with both outer and inner margins distal to pedicle weakly convex; a few relatively short acuminate setae present; length 0.22 mm., width 0.125 mm. Femur with pedicle wider than long, nearly symmetrically placed; outer margin flatly convex; inner margin weakly convex in the basal half but very slightly concave to straight in the distal half; two long sensory setae on dorsal surface, one within the basal one-fourth of the podomere and the other about one-third of the podomere length from the distal end; length of femur 0.355 mm., width 0.134 mm. Tibia with heavy pedicle about as long as wide; outer margin flatly convex in the distal two-thirds, a little more convex beyond; inner margin convex; one large and two or three small slit-like lyrifissures on the dorsal side near the base; length 0.378 mm., width 0.155 mm. Chela from the dorsad with both margins weakly convex; chela not especially narrowed at finger base; pedicle near center of rounded proximal margin; fingers fairly stout and curved; two or perhaps more especially long pseudotactile setae near the base; length of chela 0.61 mm., width 0.2 mm.; hand length without pedicle 0.305 mm. Chela from the side subrectangular; dorsal margin flatly convex with a small nodule on the dorsal margin near the juncture of the hand and the fixed fingers; ventral margin almost straight; pedicle placed a little nearer the ventral than the dorsal margin; fixed finger fairly stout, outer margin convex, inner margin almost straight; movable finger a little more slender, inner margin virtually straight, outer margin weakly convex; depth of hand 0.195 mm., subequal to hand width; length of movable finger 0.3 mm., subequal to length of hand without pedicle. About 30 contiguous marginal teeth on each finger; teeth small, conical, and acute at the distal end of the row but very wide, flattened, and acuspid at the proximal end; at level of tactile seta *et* 10 teeth cover between 0.05 and 0.055 mm. of the fixed finger margin, the proximal five teeth of the row of the fixed finger cover an equal area; nodus ramosus of fixed finger seems to be about midway between tactile seta *et* and the end of the finger, nodus ramosus of opposing finger about the same distance from the finger tip. Movable finger with four sensory setae: *t* about three-sevenths of the finger length from the tip; *st* midway between the base of the finger and *t; sb* about one areolar diameter toward the inner margin of the finger and slightly proximal to *st; b* midway between *st* and the finger base. Eight tactile setae of fixed finger as follows: *et* one-fourth or more of finger length from tip; *est* near the midpoint of the finger but showing much variation in position; *it* only a fractional part of an areolar diameter distal to the level of *est; esb* a little farther from *est* than the latter is from *et; eb* little more than one areolar diameter from *esb; ist* on inner face of finger and nearly on a level with *esb* or *eb; isb* on the dorsal surface of the finger and little basal to the level of *ist; ib* subdorsal in position and about two areolar diameters from *isb*.

Legs: Moderately stout; light yellow color; setae sparse except on tarsal podomeres; tarsal claws simple; arolium extending much beyond the tips of the claws. First leg with trochanter subtriangular, extensor margin extremely short, flexor margin weakly convex, length 0.092 mm., depth 0.083 mm.; pars basalis of femur with very weakly convex outer margin, inner margin a little more convex, deepest at the distal end, length 0.117 mm., depth 0.084 mm.; pars tibialis with both margins weakly convex, very deep throughout, length 0.133 mm., depth 0.09 mm.; tibia with inner margin weakly convex, outer margin virtually straight in the distal half, length 0.165 mm., depth 0.057 mm.; metatarsus subcylindrical, length 0.075 mm., depth 0.04 mm.; telotarsus with both margins weakly convex, length 0.084 mm., depth 0.036 mm. Fourth leg with trochanter stout, 0.135 mm. long, 0.112 mm. deep, flexor margin virtually straight, extensor margin highly arched; pars basalis subtriangular, flexor margin straight except at the basal end, length 0.125 mm., depth 0.095 mm.; pars tibialis with flexor margin straight and continuous with the margin of the pars basalis, extensor margin evenly convex, length 0.315 mm., depth 0.16 mm.; entire femur with a few setae on the flexor surface, length 0.38 mm., depth 0.16 mm.; tibia with both margins weakly convex, the flexor more so than the extensor, length 0.26 mm., depth 0.087 mm.; metatarsus subcylindrical, tactile seta long and inserted within the basal one-sixth of the podomere, length 0.1 mm., depth 0.054 mm.; telotarsus with both margins weakly convex, setae numerous, two long pseudotactile setae on the distal half of the extensor margin, length 0.117 mm., depth 0.044 mm.

Genital complex: Posterior operculum apparently with four well-spaced marginal setae; two pairs of setae on the posterior rim of the genital aperture and two groups of three setae each on the anterior rim of the aperture.

FEMALE: In general much like the male; length 2.2 mm. Carapace 0.53 mm. long, greatest width 0.41 mm., ocular width 0.295 mm. Abdomen about 1.7 mm. long, length 2.5 times the width; each of the first two tergites with a single pair of setae, other tergites with two pairs; sternites and stigmatic plates as in the opposite sex.

Chelicera: Almost identical with that of the male; width of base 0.095 mm.; length of chelicera 0.15 mm.; length of movable finger 0.13 mm.; external serrula of about 17 or 18 plates (position precludes exact count); galea relatively longer than in the male, trifid in the terminal one-third, rami more curved than in the male.

Palpus: Much stouter and somewhat darker than in the male; otherwise more or less similar. Maxilla 0.27 mm. long, length about 1.65 times the width, chaetotaxy of apical process as in the male; trochanter 0.23 mm. long, 0.13 mm. wide. Femur with dorsal setae well developed, the proximal one located in the basal one-fourth of the podomere, the distal one about two-fifths of the podomere length from the distal margin; length 0.35 mm., width 0.155 mm. Tibia 0.38 mm. long, 0.175 mm. wide; both margins markedly convex, the outer more so near the center than toward the ends. Chela with outer margin flatly convex, the inner margin a little more convex; pedicle placed a little toward the outer side; length of chela 0.635 mm., width 0.232 mm.; hand length 0.33 mm. From the side, somewhat similar to the chela of the male; dorsal margin a little more convex; fixed finger with both margins weakly convex; movable finger much more curved than in the male, inner margin very concave; depth of hand 0.23 mm.; length of movable finger 0.32 mm. Marginal teeth (position prevents an exact count) of fingers much as in the male except apparently 35 or more on each finger; at the level of *et* 10 teeth cover approximately 0.06 mm. of the finger margin; nodi ramosi as in the male. Movable finger with *t* slightly distal to midpoint of finger; other tactile setae essentially as in the male. Fixed finger with most tactile setae placed as in the male except *isb* on the external surface of the finger about two areolar diameters distal to *esb; ist* a little proximal to the level of *isb* and on the inner face of the finger.

Legs: In general as in the male. First leg: pars basalis 0.129 mm. long, depth 0.089 mm.; pars tibialis 0.135 mm. long, depth 0.91 mm.; tibia length 0.17 mm., depth 0.061 mm.; metatarsus 0.069 mm. in length, depth 0.045 mm.; telotarsus 0.092 mm. long, 0.04 mm. deep. Fourth leg as in the male except podomeres a little larger and flexor margin of femur very weakly convex; trochanter 0.16 mm. long, 0.11 mm. deep; pars basalis 0.14 mm. long, 0.097 mm. deep; pars tibialis 0.335 mm. long, 0.163 mm. deep; entire femur 0.41 mm. long, 0.163 mm. deep; length of tibia 0.285 mm., depth 0.089 mm.; metatarsus 0.106 mm. long, 0.057 mm. deep; telotarsus 0.117 mm. in length, depth 0.05 mm.

Genital complex: Each operculum with four marginal or submarginal setae; cribiform plates of lateral pair moderately large; median cribiform plates represented by what appears to be a relatively large mass of fused plates.

TRITONYMPH: General characteristics as in the male; body a little stouter, length 1.65 mm.; carapace 0.415 mm. long, both greatest width and posterior width 0.34 mm., ocular width 0.25 mm.; eyes and chaetotaxy as in the adult. Abdomen like that of the male except slightly stouter, length 1.65 mm., length about 2.2 times the width; tergites 1 and 2 with one pair of setae, others with two pairs.

Chelicera: In most respects like that of the adult but slightly smaller; width of base 0.08 mm.; length of chelicera 0.125 mm.; length of movable finger 0.1 mm.; galeal seta much shorter than galea; galea trifid in the distal one-third, rami well curved.

Palpus: With exception of the chela, much like the palpus of the female but podomeres stouter, color lighter, and fewer setae; granules on the inner surface of the hand at the finger base almost wanting. Maxilla with general features and apical process as in the adult, length 0.2 mm., about 1.5 times the width; trochanter 0.175 mm. long, width 0.105 mm.; femur fairly stout, outer margin flatly convex, inner margin markedly convex in the basal half, pedicle short and stout, tactile setae of dorsal surface much as in the female, length of femur 0.26 mm., width 0.115 mm.; tibia with base stouter than in the adult, both margins convex, length 0.275 mm., width about 0.13 mm.; chela very similar to that of the male, length 0.472 mm., width 0.168 mm., length of hand without pedicle 0.255 mm. In side view, chela chiefly as in the female, with inner margin of fixed finger convex and movable finger much curved; depth of chela 0.173 mm.; length of movable finger 0.235 mm. Teeth of chelal fingers similar to those of adult except fewer in number, about 25 on each finger. Movable finger with three tactile setae: *t* near the midpoint of the finger; *sb* (or *st?*) a little closer to *t* than to the finger base; *st* (or *sb?*) wanting; *b* about midway between *sb* or *st* and the finger base. Fixed finger with seven tactile setae: *et* about one-third of the finger length from tip; *it* a little proximal to the midpoint of the finger and slightly distal to the level of *est* which is somewhat more than one-third of the finger length from the base; *esb* and *eb* located at the finger base on the external surface, separated by less than two areolar diameters; *ist* located near the finger base, slightly proximal to the level of *esb* and less than two areolar diameters distal to the level of *ib; ib* subdorsal in position at very base of finger; *isb* wanting.

Legs: Much as in the adult except podomeres smaller and a little stouter. First leg with pars basalis 0.092 mm. in length, depth 0.066 mm.; pars tibialis 0.095 mm. long, depth 0.069 mm.; tibia with length 0.129 mm., 0.05 mm. long; metatarsus 0.055 mm. long, 0.039 mm. deep; telotarsus 0.076 mm., length 0.035 mm. Fourth leg much as in the adult except the flexor margin of the tibia is more convex; pars basalis 0.11 mm. long, 0.083 mm. deep; pars tibialis 0.239 mm. in length, depth 0.127 mm.; entire femur 0.304 mm. long; tibia 0.205 mm. long, 0.073 mm. deep; metatarsus 0.076 mm. long, depth 0.05 mm.; telotarsus 0.1 mm. in length, 0.044 mm. in depth.

TYPE LOCALITY: Three individuals, the male holotype, the female allotype, and a tritonymph paratype from a collection made by Dr. A. H. Strickland from surface litter on a cacao estate at St. Augustine, Trinidad, British West Indies, between November 16, 1943, and February 23, 1944. Several other species of pseudoscorpions, including the new species *Neopachyolpium longum* and two undescribed species of Heterosphyronida, in the same collection.

Novohorus cinereus may be separated easily from *N. suffuscus* through the much smaller palpal podomeres, the shorter movable finger, and the closely placed tactile setae *sb* and *st* in the former.

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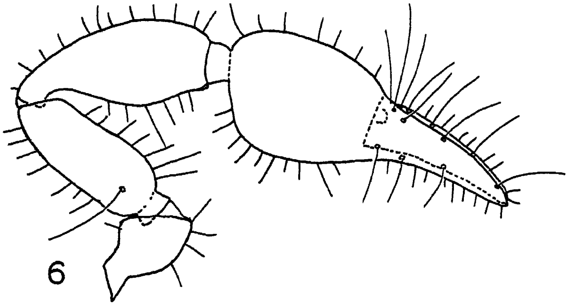
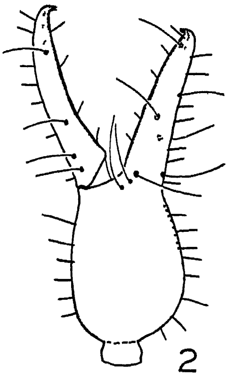
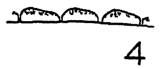
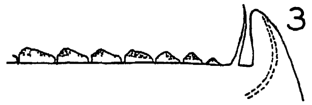
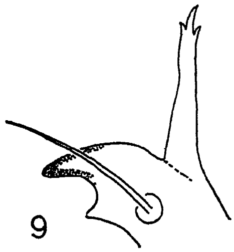
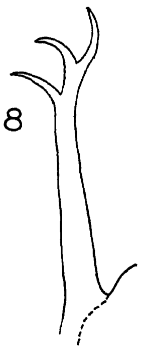


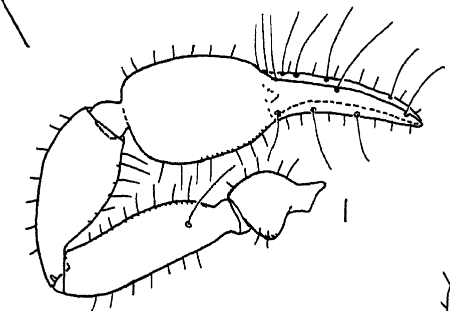


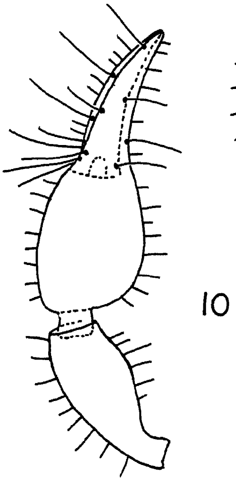


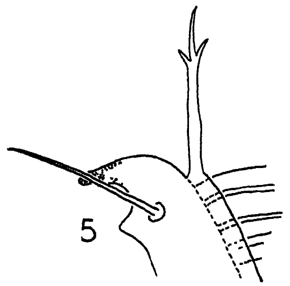












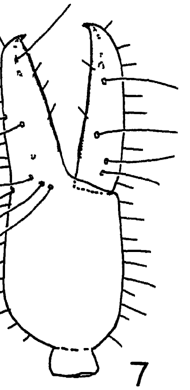
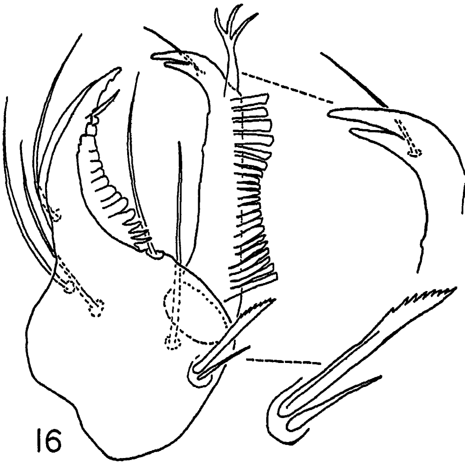


Fig. 1. *Pachyolpium aureum*, new species, dorsal view of palpus, male paratype.
Fig. 2. Idem, lateral view of chela, male holotype.
Fig. 3. Idem, tip of fixed chelal finger to show marginal teeth, male holotype.
Fig. 4. Idem, teeth of proximal portion of marginal row of fixed chelal finger, male holotype.
Fig. 5. *Pachyolpium puertoricensis*, new species, end of movable finger of chelicera, male paratype.
Fig. 6. Idem, dorsal view of palp, male holotype.
Fig. 7. Idem, lateral view of chela, male holotype.
Fig. 8. Idem, galea of female allotype, drawn to same scale as figure 5.
Fig. 9. *Pachyolpium confundens*, new species, tip of movable finger of chelicera with serrula omitted, male holotype.
Fig. 10. Idem, dorsal view of palpal tibia and chela, male holotype.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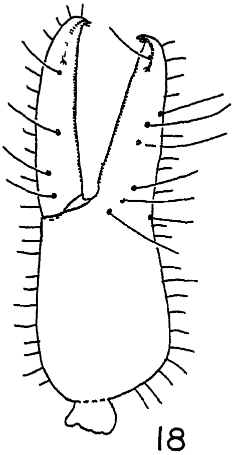
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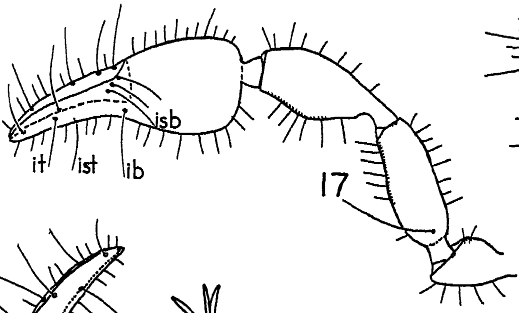
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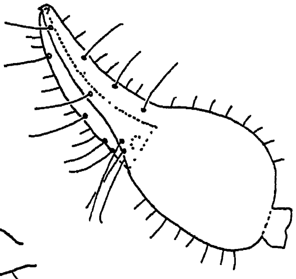
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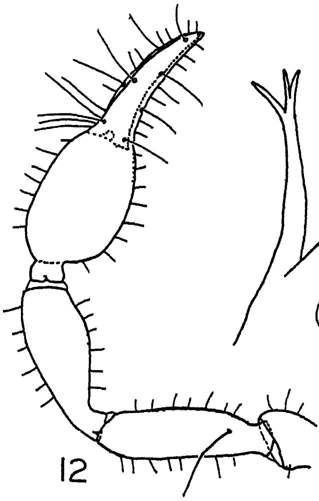
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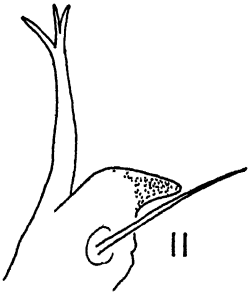
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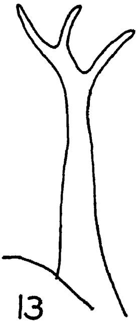
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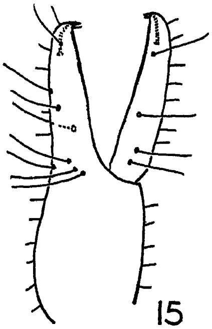
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Fig. 11. *Pachyolpium medium*, new species, tip of movable finger of chelicera, serrula omitted, male holotype.
Fig. 12. Idem, dorsal view of palp, male holotype.
Fig. 13. Idem, galea of female paratype, drawn to same scale as figure 11.
Fig. 14. Idem, dorsal view of chela, female allotype, drawn to same scale as figure 12.
Fig. 15. Idem, lateral view of chela, female allotype.
Fig. 16. *Neopachyolpium longum*, new species, chelicera and details of male holotype.
Fig. 17. Idem, dorsal view of palp, male holotype.
Fig. 18. Idem, lateral view of chela, male holotype.

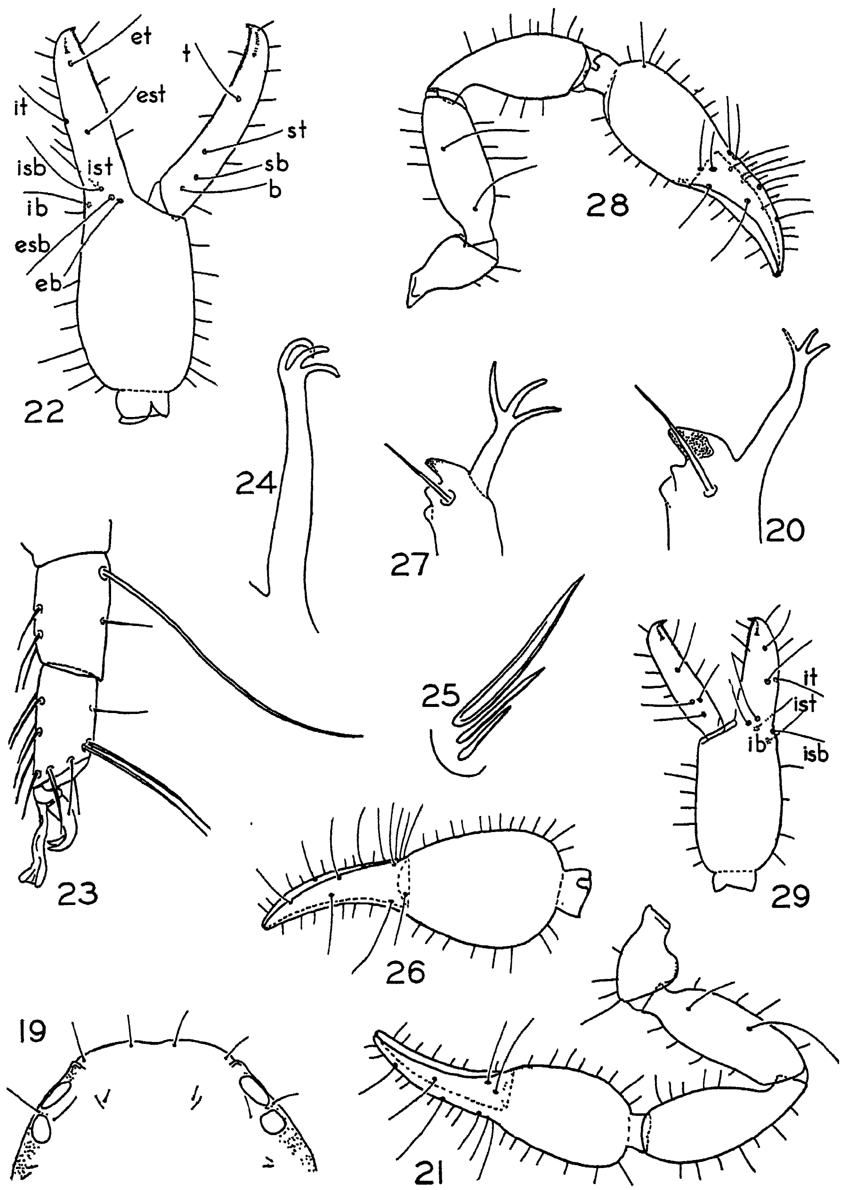

Fig. 19. *Novohorus suffuscus*, new species, anterior portion of carapace, male holotype.
Fig. 20. Idem, end of movable finger of chelicera, male holotype; serrula exterior omitted.
Fig. 21. Idem, dorsal view of palp of male holotype.
Fig. 22. Idem, lateral view of chela of male holotype.
Fig. 23. Idem, tarsal podomeres of fourth leg, male holotype.
Fig. 24. Idem, galea of female allotype, drawn to same scale as figure 20.
Fig. 25. Idem, flagellum of female paratype.
Fig. 26. Idem, dorsal view of chela, female allotype, drawn to same scale as figure 21.
Fig. 27. *Novohorus cinereus*, new species, tip of movable finger of chelicera, male holotype, serrula exterior omitted.
Fig. 28. Idem, dorsal view of palp, male holotype.
Fig. 29. Idem, lateral view of chela, male holotype.

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NEW MICRYPHANTIDAE AND DICTYNIDAE WITH NOTES ON OTHER SPIDERS

BY B. J. KASTON[1]

This paper, the second of the series, represents a continuation of my studies on American spiders, primarily from the New England region. The types of the new species here described are deposited in the collection of the American Museum of Natural History. For kind advice, access to the collections in their care, and the loan of specimens, thanks are due Dr. W. J. Gertsch of the American Museum, and Miss E. B. Bryant of the Museum of Comparative Zoölogy. I am also indebted to Mr. Wilton Ivie for sending material for comparison, and to my wife, who prepared all the illustrations.

Agelenidae

Wadotes tennesseensis Gertsch

Figure 21

Wadotes tennesseensis GERTSCH, 1936, Amer Mus. Novitates, no. 852, p. 14, fig. 27, ♀ ♂.

Coelotes hybridus BISHOP AND CROSBY, 1926, Jour. Elisha Mitchell Sci. Soc., vol. 41, p. 199 (in part), pl. 25, fig. 49, ♀ (not *hybridus* Emerton).

Bishop and Crosby undoubtedly confused *hybridus* (Emerton) with this species as both are found in the same region. They refer to the subspatulate scape of the epigynum as "narrower at the base than in the middle," a character that fits this species but not *hybridus*. In the latter the scape is broadly triangular, widest at the base (compare figs. 20 and 21). Moreover, specimens of *hybridus* from New England, Georgia, North Carolina, and Tennessee seen by me all average between 11 and 14 mm. in length, while they refer to some specimens as small as 7 mm. These small ones must be *tennesseensis*, a paratype of which I found to be 8.1 mm. long.

Dictynidae

Dictyna hentzi, new species

Figures 4–6

Dictyna muraria EMERTON, 1888, Trans. Connecticut Acad. Sci., vol. 7, p. 445 (in part); EMERTON, 1902, Common spiders, p. 210 (in part), fig. 486, ♂.

MALE: Total length, 2.3 mm. Carapace, 0.97 mm. long, 0.72 mm. wide.

Carapace and sternum dark brown with a dense whitish pubescence. Chelicerae dark brown. Abdomen creamy gray with a dark gray median longitudinal band at the anterior end followed by several indistinct chevrons. Venter dark gray in center, lighter toward sides. Legs yellowish brown with indistinct light gray annulations.

Structure typical, with head much elevated. Chelicerae concave in front and bowed as usual, with a conspicuous basal process or mastidion. Labium wider than long (15/12), sternum longer than wide (38/32) truncated behind, separating coxae IV by about their length.

Palpal tibia not much widened distally, twice as long as patella and bearing near its base a short apophysis with two closely set teeth. Palpal organ as figured with the conductor twisted at its distal end.

FEMALE: Total length, 2.8 mm. Carapace, 1.07 mm. long, 0.87 mm. wide.

In color and structure essentially like male.

Epigynum as figured with a median septum separating the two openings. The anterior rims of the openings are very weakly sclerotized.

TYPE LOCALITY: Male holotype and female allotype taken at Cheshire, Connecticut, June 2, 1935 (H. L. Johnson). Male and female paratypes were collected

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[1] Brenau College, Gainesville, Georgia.

in copula, South Meriden, Connecticut, May 30, 1935 (H. L. Johnson), and I have specimens from several other localities in Connecticut. Male paratype taken at Ramsey, New Jersey, June 5, 1938 (B. J. Kaston).

This species has been confused with *muraria* Emerton (which itself has long been thought to be a synonym of *sublata* Hentz). In general appearance it is quite like *muraria* and varies quite as much too, so that the six drawings of abdominal patterns supplied by Emerton can also apply to this species. The carapace is, however, somewhat darker. It averages somewhat smaller in size, females ranging from 2.1 to 2.8 mm. and males from 2 to 2.3 mm. (as compared with 2.9 to 4.4 mm. and 2.4 to 3.8 mm., respectively, for *muraria*). In males the basal process on the chelicera is much more conspicuous than in *muraria*. Moreover, the palp has the tibia narrower and the distal end of the conductor shorter and thinner. In the epigynum the median septum is wider, and the anterior rims of the openings are less sclerotized.

Dictyna muraria Emerton

Figures 1–3

Dictyna muraria Emerton, 1888, Trans. Connecticut Acad. Sci., vol. 7, p. 445 (in part), pl. 9, figs. 1–1g, ♀♂; Emerton, 1902, Common spiders, p. 210 (in part, not fig. 486).

Dictyna sublata Banks, 1891, Ent. News, vol. 2, p. 85; Comstock, 1912, Spider book, p. 281, figs. 263–266 (not *sublata* Hentz).

Dictyna vigilans Gertsch and Ivie, 1936, Amer. Mus. Novitates, no. 858, p. 8, fig. 26, ♂.

This species and the preceding one, *hentzi*, had been confused by Emerton. Both occur in the same situations and same regions, but I have found this one far less common in Connecticut. At the Museum of Comparative Zoölogy is a male from Hagerstown, Maryland, that is referable to *muraria*, but I have seen none from farther south. Following Banks, most workers have been synonymizing *muraria* under *sublata* Hentz, but, as Chamberlin and Ivie have shown, it is far more likely that *sublata* is really what has been described as *volupis* by Keyserling and by Emerton, and been called *foliacea* by most later workers. At any rate, Dr. A. F. Archer, who did extensive collecting in Alabama for several years, was never able to find anything that could be considered Emerton's *muraria*.

The structural differences between *muraria* and *hentzi* are discussed under the latter, above.

Dictyna sublata (Hentz)

Figures 7–9

Theridion sublatum Hentz, 1850, Jour. Boston Soc. Nat. Hist., vol. 6, p. 276, pl. 9, fig. 10, ♀.

Dictyna volupis Keyserling, 1881, Verhandl. zool.-Bot. Gesellsch. Wien, vol. 31, p. 285, pl. 11, fig. 10, ♀; Emerton, 1888, Trans. Connecticut Acad. Sci., vol. 7, p. 488, pl. 9, figs. 8–8c, ♀♂.

Dictyna sublata Chamberlin and Ivie, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 122.

Dictyna foliacea of most authors.

Banks, in 1910, listed *volupis* as a synonym of *foliacea* (Hentz), and as he was followed in this by Petrunkevitch and later authors this common species came to be known generally by that name. I think it will be agreed that Chamberlin and Ivie are correct in considering *volupis* as a synonym of *sublata* (Hentz), and that *foliacea* (Hentz) is an entirely different species.

This species is intermediate in size between *muraria* and *hentzi* and has genitalia of the same type. Figures of the palp and epigynum are supplied here for comparison.

Dictyna foliacea (Hentz)

Theridion foliaceum Hentz, 1850, Jour. Boston Soc. Nat. Hist., vol. 6, p. 277, pl. 9, fig. 14, ♀.

Dictyna frondea Emerton, 1888, Trans. Connecticut Acad. Sci., vol. 7, p. 449, pl. 9, figs. 9–9a, ♀♂.

Not *Dictyna foliacea* of most authors.

That *frondea* is a synonym of *foliacea* Hentz was first suggested by Banks in 1891. While Emerton figured a specimen with a narrow median light band on the abdomen I have seen much variation, both in intensity and width of this band, some specimens showing it as wide as that figured by Hentz.

Dictyna roscida (Hentz)

Theridion roscidum Hentz, 1850, Jour. Boston Soc. Nat. Hist., vol. 6, p. 277, pl. 6, figs. 15, 16, ♀♂.

Dictyna rubra Emerton, 1888, Trans. Connecticut Acad. Sci., vol. 7, p. 448, pl. 9, fig. 7, ♀ ♂.

Dictyna florens Ivie and Barrows, 1935, Bull. Univ. Utah, vol. 26, no. 6, biol. ser., vol. 3, no. 2, p. 4, figs. 1–5, ♀ ♂.

Comparison of Emerton's type male with material I have from New England, and material from the American Museum labeled *florens* led me to the conclusion some time ago that *florens* was a synonym of *rubra*. Recently I examined specimens from Georgia determined by Ivie as *roscida*. I am unable to separate this latter species from the others on structural differences; the genitalia of all three agree.

Ivie considered that *roscida* and *florens* vary "mainly in color markings" but even Emerton had called attention to the variation. Most New England individuals that are mature show little yellow on the abdomen, while the southern specimens are more strikingly marked. Yet I have Connecticut specimens in the penultimate instar which show large areas of yellow. In a pair I have from Tuscaloosa, Alabama (where Hentz did much of his collecting), the female has almost the entire dorsum yellow, while the male has the yellow restricted to small spots as in Hentz's figures of both sexes.

Dictyna sylvania Chamberlin and Ivie is very closely related to this species.

Dictyna decaprini, new species

Figure 10

Female: Total length, 1.55 mm. Carapace, 0.65 mm. long, 0.492 mm. wide. Abdomen, 0.97 mm. long, 0.58 mm. wide.

Carapace brownish yellow with irregular gray streaks and a fine black marginal line either side. Sternum grayish yellow, darker along borders. Legs like sternum, somewhat lighter on ventral than dorsal surfaces. Abdomen evenly gray, darker above without markings.

Structure typical. Sternum longer than wide (26/23), truncate behind so that coxae IV are separated by their length. Maxillary lobes inclined over labium which is wider than long (10/7).

Epigynum distinctive, as figured.

Type Locality: Holotype female, taken at Branford, Connecticut, July 2, 1937 (B. J. Kaston). Named in honor of my friend Alphonso deCaprio, who has collected many interesting Connecticut spiders.

SCOTOLATHYS SIMON

Simon, 1884, Bull. Soc. Zool. France, vol. 9, p. 321. Genotype: *S. simplex* Simon.

Although this genus was erected for a spider which has only six eyes, Simon later included *heterophthalma* Kulczynski, in which the anterior medians are present, though barely perceptible, very minute, and lying close to the sides of the laterals in the area of black pigment surrounding the latter. One American species, *pallidus* (Marx) (presumably also *alba* Chamberlin and Ivie), is similar to *simplex*, in that the anterior median eyes have never been detected, while in a second, *maculatus* (Banks), the situation is comparable to *heterophthalma*. On the basis of the presence of these tiny eyes Bryant (1943) resurrected *Dictyolathys* Banks. I have examined several specimens of *maculatus* and find that the minute anterior medians, while barely perceptible in some individuals, cannot be made out in others. This same type of variation among individuals is exactly what was reported by Gertsch and Mulaik in the description of their *delicatulus*.

In my opinion we have here a phenomenon which is encountered in other lucifugous spiders. As is generally well known, many spiders that are endogean, troglophilic, or troglobiotic not only tend to be lighter in color than their epigean relatives but show a tendency for the eyes to be reduced in size and in number, the anterior medians being affected first. This has been particularly well demonstrated by A. R. Jackson and by L. Fage in several species of the European *Porrhomma* and is discussed in some detail in Berland's (1932) "Les arachnides," and Bristowe's (1939) "Comity of spiders." In *P. egeria* Simon, endogean specimens may have all eight eyes, while troglophilic individuals sometimes lack the anterior medians. Moreover, as is pointed out in a discussion below, some species of *Nesticus* have all eight eyes, others have them reduced in size, still others have the number reduced to six, and finally, all eyes are lacking in the troglobiotic species *lusitanicus* Fage.

Bryant states that in *maculatus* the posterior lateral eyes are larger than the medians and than the anterior laterals, a character of *Dictyolathys*, while in *Scotolathys* the anterior laterals should be largest. However, I have found the differences minute, less than a single unit of the micrometer when using the highest power of the binocular microscope, and am of the opinion that these can be considered as only of, at most, specific rather than generic importance. In fact, all the species are so near *Lathys* in this respect, in which the eyes, except for the tiny anterior medians, are subequal in size, and so much like *Lathys* in details of genitalia structure, that it may become impossible ultimately to maintain *Scotolathys* separate from that genus.

Nesticidae

NESTICUS THORELL

THORELL, 1869, Nova Acta Reg. Soc. Sci. Upsaliensis, ser. 3, vol. 7, p. 88. GENOTYPE: *Aranea cellulana* Olivier.

Ivesia PETRUNKEVITCH, 1925, Ann. Ent. Soc. Amer., vol. 18, p. 320. GENOTYE: *I. tennesseensis* Petrunkevitch.

Petrunkevitch compared his *Ivesia* to his genus *Theridionexus*, "from which it may be differentiated by the presence of only six eyes (anterior median eyes wanting) and by the wider separation of the posterior median eyes." However, he later (1928) admitted *Theridionexus* to be a synonym of *Nesticus*, and I am of the opinion that a study of Kratochvíl's thorough revision of the group will convince one that *Ivesia* is a synonym too. As is shown by Kratochvíl (1933), the loss of two or more eyes has occurred in several species in this group; in fact, within the same species there may be subanophthalmic individuals with the anterior medians sometimes missing, and the remaining eyes smaller (so that, as in *tennesseensis*, they are consequently more widely spaced). Further, there are some species that are completely anophthalmic, but the structure of the other parts of the body and in particular of the male palpus with its relatively immense paracymbium leaves no room for doubt as to the genus to which belong the species concerned. On the basis of the genitalia Petrunkevitch's species most closely resembles *N. speluncarum*, of which the subspecies *speluncarum* Pavesi likewise has the anterior median eyes sometimes lacking. Through the courtesy of Professor Ives I had the opportunity of examining specimens identified as *tennesseensis* and found among them a male with the anterior median eyes present.

Due to the same composite of characters which led Thorell to establish *Nesticus* as a new genus (in the family Theridiidae, *sensu lato*), there is still a difference of opinion as to the family in which the genus should be placed. This group of spiders has been considered by Simon, and following him Petrunkevitch, Comstock, and Berland, as a part of the Tetragnathinae. In 1928 Petrunkevitch moved it to the Theridiidae, where it is left by Bristowe (1939), and in 1939 to the Linyphiidae, while by Dahl (1913), Reimoser (1919), and Roewer (1929) it was placed in the Micryphantidae. In 1926 Dahl set it apart as a separate family, and that there is justification for this was suggested as far back as 1910 by Petrunkevitch himself, and has been shown by Gerhardt (1927) from the point of view of sexual biology, and by Kratochvíl (1933) from the point of view of morphology.

Theridiidae

Coleosoma flavipes O. P.-Cambridge

Coleosoma flavipes O. P.-CAMBRIDGE, 1895, Biologia Centrali Americana, vol. 1, p. 154, pl. 19, fig. 12, ♂; BRYANT, 1944, Psyche, vol. 51, p. 52, figs. 1, 4, 7, 9, ♀ ♂.

Achaea index CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 36, figs. 87, 105, ♀ ♂.

Theridion differens Emerton

Figure 14

Theridium differens EMERTON, 1882, Trans. Connecticut Acad. Sci., vol. 6, p. 9, pl. 1, figs. 1–1b, ♀ ♂ (not figs. 1c or 1d); EMERTON, 1909, *ibid.*, vol. 14, p. 180, pl. 1, fig. 7, ♀.

Theridion spirale MUMA, "1943" [1944], Common spiders of Maryland, pl. 13, fig. 4, ♀.

This species and the two following, *murarium* and *spirale*, resemble one another very much in size and abdominal pattern and can be distinguished with certainty only by means of the genitalia. This is fairly easy with males, but there has been confusion in telling the females apart. New drawings of the epigyna, made from type specimens in each case, are included in the present paper. It can be seen that the openings are more than twice their diameter apart in *murarium*, and less than this in the other two. In *differens* the openings are more than a diameter apart and sunk below the surface of the plate so that there is a broad ridge between them, while in *spirale* they are less than a diameter apart and not sunk below the surface of the plate.

Theridion spirale Emerton

Figure 13

Theridium spirale EMERTON, 1882, Trans. Connecticut Acad. Sci., vol. 6, p. 10, pl. 1, figs. 2–2d, ♀ ♂.

Theridion differens MUMA, "1943" [1944], Common spiders of Maryland, pl. 13, fig. 2, ♀.

For characters distinguishing this species from *murarium* and *differens* see under the latter, above.

Theridion murarium Emerton

Figure 15

Theridium murarium EMERTON, 1882, Trans. Connecticut Acad. Sci., vol. 6, p. 11, pl. 1, figs. 5–5b, ♀ ♂.

For characters distinguishing this species from *spirale* and *differens* see under the latter, above.

Theridion albidum Banks

Figures 16, 17

Theridium albidum BANKS, 1895, Jour. New York Ent. Soc., vol. 3, p. 84, ♀ ♂.

Theridion frondeum MUMA, "1943" [1944], Common spiders of Maryland, pl. 13, fig. 3, ♀.

This species and the next species, *frondeum* Hentz, resemble each other closely, and in both the abdominal pattern varies. But in this species most individuals are like the lightest of *frondeum*, with at most only a few black dots. To be distinguished with certainty recourse must be had to the genitalia, and figures from Banks' types are supplied here. In *frondeum* the median apophysis of the palpal organ is rather deeply cleft, the distal ramus is fairly thin and is more or less paralleled by the proximal ramus, while in *albidum* the two rami are divergent and the distal one is quite thick. The epigynum of *frondeum* has its posterior border thickened, darkly pigmented, and raised slightly behind the crescent-shaped opening (which is usually dark as in fig. 18). In *albidum* the posterior border is not so broad and thick, and there is a dark dumbbell-shaped structure, sometimes divided into two at the middle, behind the opening (which is generally light as in fig. 16).

Theridion frondeum Hentz

Figures 18, 19

Theridion frondeum HENTZ, 1850, Jour. Boston Soc. Nat. Hist., vol. 6, p. 275, pl. 9, fig. 7, ♀; EMERTON, 1882, Trans. Connecticut Acad. Sci., vol. 6, p. 15, pl. 3, figs. 1–1h, ♀ ♂.

For characters distinguishing this from the very similar but less well known *albidum*, see under that species, above.

Theridion blandum Hentz

Figures 11, 12

Theridion blandum HENTZ, 1850, Jour. Boston Soc. Nat. Hist., vol. 6, p. 278, pl. 9, fig. 20, ♀ (not *Theridion blandum* Simon).

Theridion intervallatum EMERTON, 1915, Trans. Connecticut Acad. Sci., vol. 20, p. 136, pl. 1, figs. 1–1b, ♂.

Emerton's type male from Intervale, New Hampshire, July 18, 1913 (E. B. Bryant), and another male collected by Emerton on Nantucket Island, Massachusetts, June 20, 1929, both exactly match females, presumably *blandum*, from Falls Church, Virginia, and Memphis, Tennessee. Both the palpus and the epigynum are simple, the latter being essentially a concave plate.

Linyphiidae

Lepthyphantes zebra (Emerton)

Bathyphantes zebra EMERTON, 1882, Trans. Connecticut Acad. Sci., vol. 6, p. 69, pl. 22, figs. 2–2a, ♀ ♂.

Bathyphantes decorata BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 44, pl. 2, fig. 41, ♀ ♂.

Lepthyphantes zebra ZORSCH, 1937, Amer. Midland Nat., vol. 18, p. 887, pl. 5, figs. 67–72, ♀ ♂.

Of the species described by Banks (1892) under *Bathyphantes,* several were later considered by him as synonyms of *zebra.* Examination of the type specimens of *B. decorata* convinces me that it likewise belongs here.

Bathyphantes pallida (Banks)

Diplostyla nigrina EMERTON, 1882, Trans. Connecticut Acad. Sci., vol. 6, p. 65, pl. 20, fig. 2–2d, ♀ ♂ (not *Linyphia nigrinus* Westring).

Diplostyla pallida BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 43, pl. 2, fig. 29, ♀ ♂ (not *Bathyphantes pallidus* Banks, 1892).

Bathyphantes pallidus CHAMBERLIN AND IVIE, 1943, Bull. Univ. Utah, vol. 33, no. 10, biol. ser., vol. 7, no. 6, p. 22.

Bathyphantes nigrinus MUMA "1943" [1944], Common spiders of Maryland, p. 74, pl. 3, fig. 7, ♀ ♂.

For many years most American authors have wrongly followed Emerton in assuming that this spider was the same as the European *nigrina.* Chamberlin and Ivie pointed out the error and resurrected the next available name. This is *pallida,* for, as Banks stated in the 1916 revision of his 1892 paper, what he had then called *Diplostyla pallida* was merely a pale individual of what Emerton had previously described under the impression it was *nigrina.*

This species is not to be confused with the succeeding one, which Banks had described as *Bathyphantes pallida.*

Meioneta angulata (Emerton)

Bathyphantes angulata EMERTON, 1882, Trans. Connecticut Acad. Sci., vol. 6, p. 71, pl. 22, fig. 5, ♂.

Bathyphantes pallida BANKS, 1892, Proc. Acad. Nat. Sci. Philadelphia, p. 45, pl. 5, fig. 42, ♀ (not *Diplostyla pallida* Banks, 1892).

The type females of this species, described under *pallida* (not to be confused with the preceding species), agree with females taken with males known to be *angulata* and resemble the males closely.

Tennesseellum formicum (Emerton)

Figure 25

Bathyphantes formica EMERTON, 1882, Trans. Connecticut Acad. Sci., vol. 6, p. 71, pl. 22, figs. 7–7b, ♂.

Prosopotheca transversa CROSBY, 1905, Proc. Acad. Nat. Sci. Philadelphia, p. 333, pl. 29, fig. 5, juv. ♀.

Tennesseellum minutum PETRUNKEVITCH, 1925, Jour. New York Ent. Soc., vol. 33, p. 173, pl. 8, fig. 5, ♀.

Meioneta formica CHAMBERLIN AND IVIE, 1944, Bull. Univ. Utah, vol. 35, no. 9, biol. ser., vol. 8, no. 5, p. 85.

In 1928 Petrunkevitch erected a new subfamily, Tennesseellinae, for his *T. minutum,* basing it on the position of the spiracle. Crosby and Bishop (1931) pointed out that his species was a synonym of Emerton's *formica,* and that *Prosopotheca transversa* Crosby was based on an immature[1] female of the same species. They further stated, "That this species needs a subfamily or even a separate genus for its reception is extremely doubtful. The fact that the spiracular sulcus is some distance in front of the spinnerets is evidently the result of a modification toward becoming an ant mimic. In other respects it is closely related to other species of the group. The position of the spiracular sulcus is of specific value only in *Hahnia* and of generic significance only in the Anyphaeninae (Anyphaena and Gayenna)."

I believe most workers will agree that erection of at least a new genus is justifiable in this case, just as the position of the spiracular sulcus is used to differentiate genera in what we now consider the families Hahniidae and Anyphaenidae. However, that the forward position of the sulcus is not the result of a modification toward becoming an ant mimic is evident from the fact that the hahniids, anyphaenids, and others with a forwardly placed spiracle are not ant mimics. Conversely ant mimics in the genera *Micaria, Phrurolithus, Peckhamia,* and others, have the spiracle in the usual position.

Petrunkevitch (1933) prefers to consider his *minutum* as distinct from Crosby's *transversa* on the basis of several points. The chief discrepancies are the published eye relations. But it is obviously impossible with such minute spiders to measure accurately the size and spacing of the eyes. Even with the highest power of a binocular microscope, an eye, or the space between two eyes, may not quite span two units of the micrometer so that the personal factor, besides variation among specimens, must be taken into consideration. Thus if Crosby states that the anterior eyes are equidistant, and Petrunkevitch that the anterior medians are separated by a radius and are slightly more than a radius from the laterals one can hardly call that much discrepancy! The anterior row is stated by Petrunkevitch to be slightly recurved and by Crosby to be procurved. But Petrunkevitch also stated that, "Viewed from in front anterior row is very slightly curved downward." It follows therefore that the "recurved" applies to how it looked to him from above, for if from in front it is curved downward then, following Comstock (1912, pp. 97–98), the row is procurved as stated by Crosby, and as I myself have observed in material of both sexes (under *formica*) at the Museum of Comparative Zoölogy. Another discrepancy lies in the fact that Petrunkevitch reports only a single promarginal tooth on the chelicerae, while Crosby's specimens (and those seen by me) have three teeth. However, instances are known among other species where individuals differ in this respect, so it may not be impossible here. Naturally, too, there remains the discrepancy about the position of the spiracle. As Crosby did not mention it, the assumption is that it is in the usual place just in front of the spinnerets, while Petrunkevitch correctly described it as considerably in front of the spinnerets. From measurements on seven males and 10 females that I have seen it can be stated that the spiracle varies from once and a half to nearly twice as far from the epigastric furrow as from the base of the spinnerets.

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[1] It was not uncommon for immature individuals, especially females in the penultimate instar, to be described in error as adult. Often the structure of the epigynum can be faintly discerned through the cuticle. On the basis of his added experience and later collecting, which undoubtedly included males, Crosby realized his error and published (with Bishop) this correction.

That Crosby did not at first correctly describe the position of the spiracle was merely an oversight, just as had occurred when Emerton described his *formica,* and also when Petrunkevitch described his *Diplocephalus crumbi,* which is a synonym of *Mimognatha foxi* (McCook) (fig. 27). In 1933 Petrunkevitch considered that there were but three "isolated genera" with respect to the forward position of the spiracle. However, to these must be added representatives from still others. Specimens of *Diplostyla brevis* Emerton (fig. 26), *Scytodes thoracica* (Latreille) (fig. 22), *S. longipes* Lucas (fig. 23), and *S. fusca* Walckenaer (fig. 24), examined by me, all show the forwardly placed spiracle. The spiracular sulcus is fairly distinct in all of these except *S. thoracica* but can be easily seen in specimens of the latter freshly placed in alcohol, before the air in the tracheae converging to the spiracle has been replaced by fluid.

Micryphantidae

Ceratinopsis atolma Chamberlin

Figure 29

Ceratinopsis atolmus CHAMBERLIN, 1925, Proc. California Acad. Sci., ser. 4, vol. 14, p. 110, figs. 11–12, ♂.

Ceratinopsis tarsalis EMERTON, 1924, Psyche, vol. 31, p. 141 (in part), fig. 2b, ♀ (not fig. 2a, ♂).

Ceratinopsis atolma BISHOP AND CROSBY, 1930, Jour. New York Ent. Soc., vol. 38, p. 17, figs. 5–7, ♂.

The epigynum of this species has been confused by Bishop and Crosby with that of *nigripalpis* Emerton. The figure supplied (as *tarsalis*) by Emerton is quite accurate and shows the transverse posterior portion of the inverted T-shaped median lobe to be much thicker than the corresponding part in *nigripalpis.* The epigynum of the latter is more nearly like that of *nigriceps* Emerton (compare figs. 28 and 30). *C. georgiana* and *C. swanea,* both recently described by Chamberlin and Ivie, also have the epigynum of this same type and closely resemble *atolma.*

Cornicularia pinocchio, new species

Figures 31–36

MALE: Total length, 1.5 mm. The carapace, chelicerae, labium, endites, and sternum are evenly brown, the legs yellow and the abdomen pale grayish yellow.

The carapace is high in front and produced between the posterior median eyes to form a long thin horn. This horn is constricted just beyond its origin, then extends forward and downward as figured. Its distal end is armed with numerous very small bristles. From about the middle of its dorsal surface arise a single appressed spine, and from the ventral surface near the tip a pair of fine spines which extend horizontally almost reaching the clypeus. Height of clypeus about three times diameter of an anterior median eye. Median eyes of both rows about same size and slightly smaller than laterals which are subequal and contiguous. Posterior medians about a diameter apart, slightly farther from the laterals. Median ocular area slightly wider behind than in front, longer than wide. Sternum subtriangular, almost as broad as long (30/35), narrowed to a smooth rounded point extending between the posterior coxae which are separated by their length. Legs with fine hairs but no spines.

Palpus of the usual type. Patella twice the length of tibia, with the long pointed tibial apophysis bearing a short black tooth near its base.

TYPE LOCALITY: Holotype male collected at Mt. Carmel, Connecticut, April 19, 1935 (B. J. Kaston).

From all other known species this one can be distinguished by its very long cephalic horn.

Ceraticelus bryantae, new species

Figures 37–40

MALE: Total length, 1.7 mm. Carapace bright orange, darker up forward, and black on the forward projecting lobe and around the eyes. Chelicerae, maxillae, and sternum orange as also the abdominal scuta. Legs and soft integument of abdomen yellow, spinnerets black.

The carapace is high in front where it is extended to form the cephalic lobe, the clypeus slanting backward toward the chelicerae and six times the diameter of an anterior median eye. The anterior median eyes are borne virtually at the summit of the lobe, are much closer to each other than to the laterals, which almost touch the posterior laterals. Posterior median eyes slightly nearer each other than the laterals, median ocular area longer than wide and wider behind than in front. Sternum broad, truncate behind between the posterior coxae which are separated by their length. Abdomen with a scutum covering about two-thirds of the dorsum, provided with fine punctae. The epigastric region is evenly covered with a scutum, and the inframammillary scutum is restricted to the ventral side. Legs with fine hairs but devoid of spines.

Palpus as figured. Tibia longer than patella in ratio of 12:5.

FEMALE: Total length, 1.9 mm. General appearance, color, and structure, essentially as in the male. The carapace is less produced into a cephalic lobe, with the clypeus therefore less slanting and lower, only three times the diameter of an anterior median eye. The dorsal scutum is lacking, and the epigastric scutum is divided into plates over the book lungs, around the epigynum and encircling the pedicel. The epigynum has a middle lobe wide behind, narrowed in front where it extends between the tubules.

TYPE LOCALITY: Male holotype and female allotype taken by sifting forest floor litter at Tolles, Connecticut, September 20, 1936 (B. J. Kaston). A male and several female paratypes taken with the types.

From the structure of the palpus as well as of the head this species may be placed close to *pygmaeus* (Emerton) in the *emertoni* group of Crosby and Bishop. From *pygmaeus* it differs in not having the cymbium angular, and in details of the palpal organ, as well as in having a much shorter patella. In females the presence of a dorsal scutum in *pygmaeus* distinguishes the two.

Pelecopsis bishopi, new species

Figures 41–44

MALE: Total length, 1.8 mm. Carapace chestnut brown with irregular gray reticulations. Chelicerae, maxillae, and legs yellowish brown, unmarked. Sternum chestnut brown bordered with black. Abdomen dark chestnut brown on scuta, soft integument dark gray with small brown punctae.

The carapace is high in front with the cephalic lobe descending gradually behind but more steeply in front. Seen from above the lobe is marked with a longitudinal fissure which partly divides it in two. There is a posterior median eye on each half, these eyes separated by almost two diameters. The anterior median eyes are separated by a radius and are more than a diameter from the laterals which are contiguous with, and subequal to, the posterior laterals. Median ocular area much longer than broad, wider behind than in front. The clypeus is high, about four times the diameter of an anterior median eye. Each cephalic pit lies at the anterior end of a shallow groove, behind and above the posterior lateral eye of that side. Sternum slightly wider than long (33/30), truncate behind between posterior coxae which are separated by their length. Labium much broader than long. Legs with fine hairs but without spines. Abdomen broadly oval, moderately high, with virtually the entire dorsum covered by a scutum. Epigastric scutum not well developed; divided into a plate around the pedicel, and one over each book lung, with only a small extension of the lateral angles beyond the epigastric furrow. Inframammillary scutum restricted to venter.

Palpus as figured. The tibia is hardly longer than the patella and bears an apophysis with a rounded apex, slightly hooked. The tail piece of the embolic division is short, and the embolus is spirally curled.

Female: Total length, 2 mm. Agreeing with the male in general appearance and structure. The pars cephalica is somewhat raised above the pars thoracica, but there is no distinct cephalic lobe. The clypeus is only three times the diameter of an anterior median eye, and posterior eyes are equidistant and subequal in size.

The dorsal scutum is not so large as in the male, leaving more of the posterior abdominal declivity uncovered, and the punctae on the soft integument are larger and more conspicuous than in the male.

Type Locality: Male holotype from West Ossipee, New Hampshire, July 25, 1936 (S. Mulaik), and female allotype from Haddam, Connecticut, May 5, 1935 (B. J. Kaston). Two female paratypes from Voluntown, Connecticut, June 30, 1935 (B. J. Kaston).

This species resembles *sculptum* Emerton, known from British Columbia and Washington. In the male the cephalic lobe is not so high, and the embolus is more closely curled; in the female the middle lobe of the epigynum is more triangular than in that species, and the dorsal scutum is larger.

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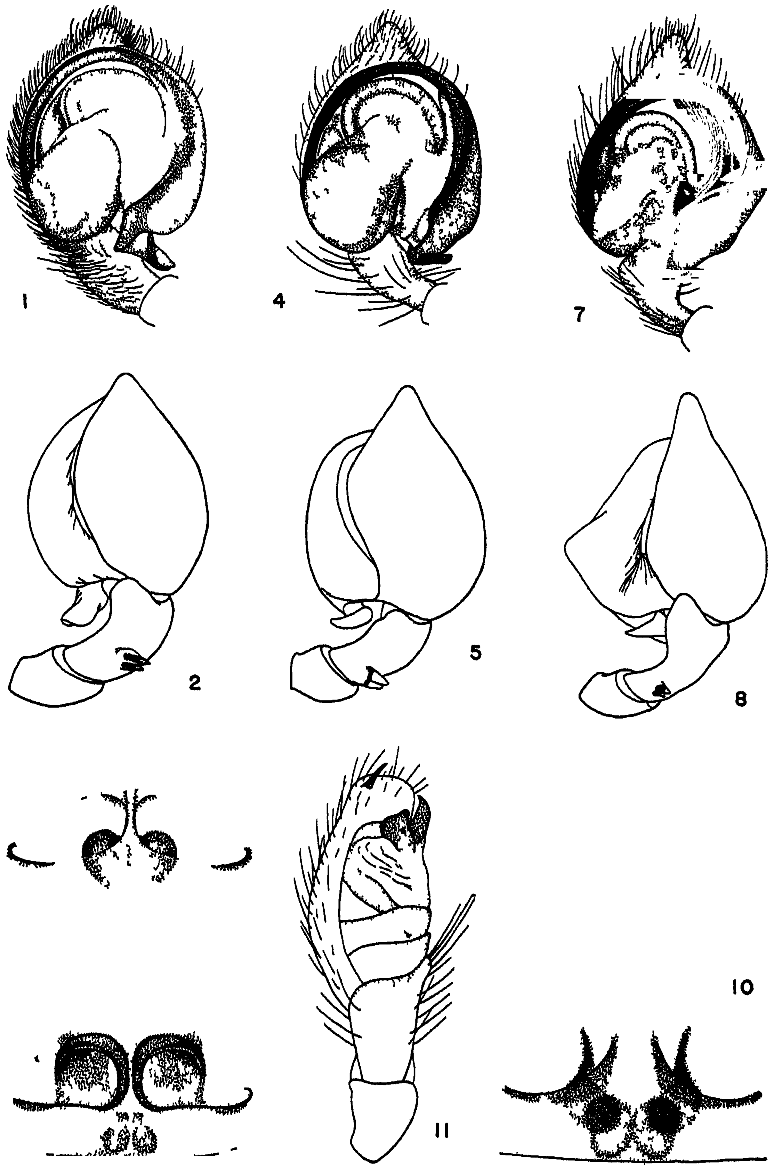
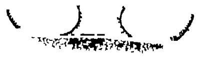
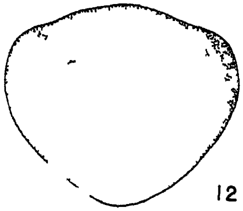


Fig 1 *Dictyna muraria* Emerton, palpus, ventral aspect
Fig 2 Idem, palpus, lateral aspect
Fig 3 Idem, epigynum
Fig 4 *Dictyna hentzi*, new species, palpus, ventral aspect
Fig 5 Idem, palpus, lateral aspect
Fig 6 Idem, epigynum
Fig 7 *Dictyna sublata* (Hentz) palpus, ventral aspect
Fig 8 Idem, palpus, lateral aspect
Fig 9 Idem, epigynum
Fig 10 *Dictyna decaprini*, new species, epigynum
Fig 11 *Theridion blandum* Hentz, palpus.





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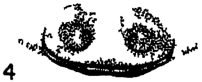

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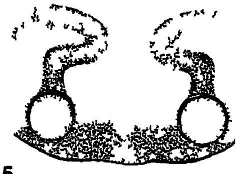

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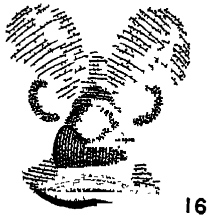

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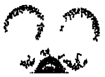

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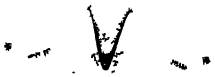

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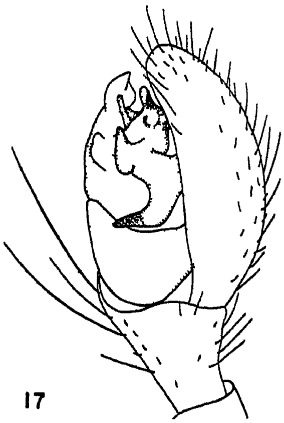

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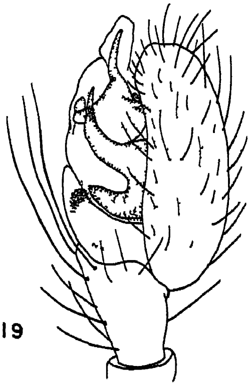

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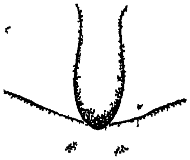

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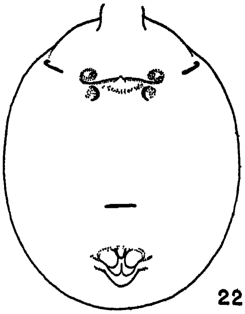
Fig 12. *Theridion blandum* Hentz, epigynum
Fig 13 *Theridion spirale* Emerton, epigynum Type specimen
Fig 14. *Theridion differens* Emerton, epigynum Type specimen
Fig 15. *Theridion murarium* Emerton, epigynum Type specimen
Fig 16. *Theridion albidum* Banks, epigynum. Type specimen
Fig 17. Idem, palpus Type specimen
Fig. 18 *Theridion frondeum* Hentz, epigynum.
Fig 19. Idem, palpus.
Fig. 20 *Wadotes hybridus* (Emerton), epigynum.
Fig. 21. *Wadotes tennesseensis* Gertsch, epigynum Paratype specimen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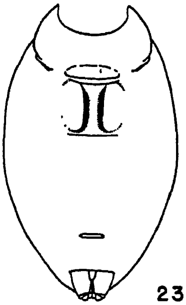
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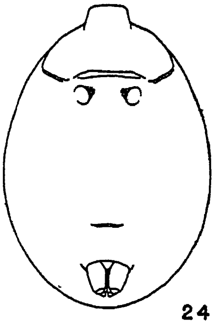
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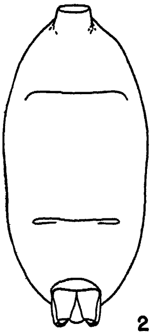
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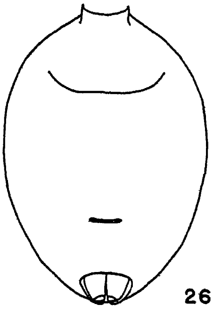
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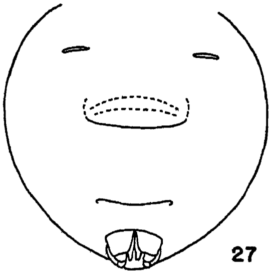
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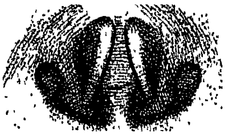

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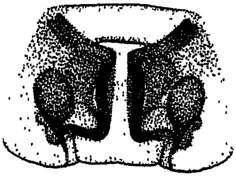

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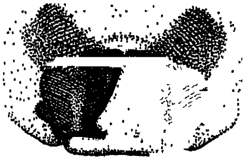
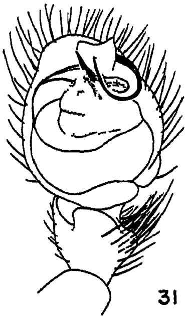


Fig. 22. *Scytodes thoracica* (Latreille), venter of female.
Fig. 23. *Scytodes longipes* Lucas, venter of female.
Fig. 24. *Scytodes fusca* Walckenaer, venter of female.
Fig. 25. *Tennesseellum formicum* (Emerton), venter of male.
Fig. 26. *Diplostyla brevis* Emerton, venter of male.
Fig. 27. *Mimognatha foxi* (McCook), venter of female.
Fig. 28. *Ceratinopsis nigripalpis* Emerton, epigynum.
Fig. 29. *Ceratinopsis atolma* Chamberlin, epigynum.
Fig. 30. *Ceratinopsis nigriceps* Emerton, epigynum.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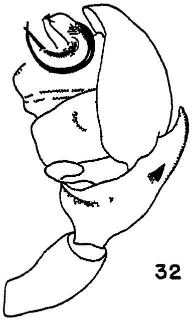
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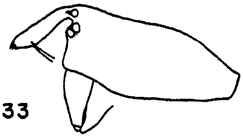
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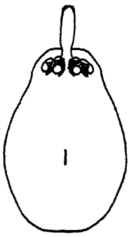
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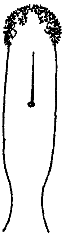
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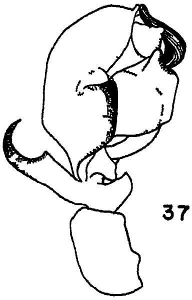
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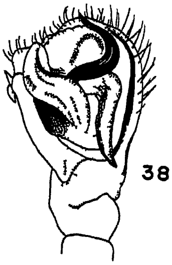
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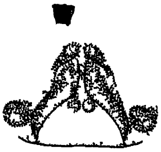
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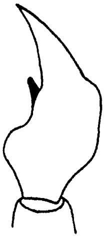
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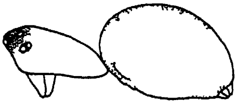
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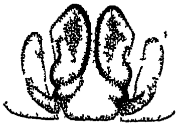
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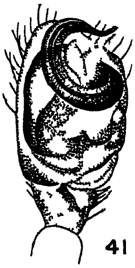
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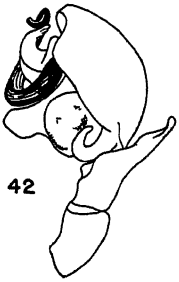
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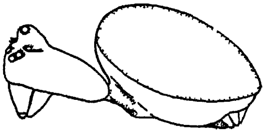
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Fig. 31 *Cornicularia pinocchio*, new species, palpus, ventral aspect
Fig 32 Idem, palpus, lateral aspect
Fig 33 Idem, cephalothorax, from the side
Fig 34 Idem, carapace, from above
Fig 35 Idem, cephalic horn, from above
Fig 36 Idem, palpal tibia from above
Fig 37 *Ceraticelus bryantae*, new species, palpus, lateral aspect
Fig 38 Idem, palpus, ventral aspect
Fig 39 Idem, body of male from the side
Fig 40 Idem, epigynum
Fig. 41. *Pelecopsis bishopi*, new species, palpus, ventral aspect
Fig. 42. Idem, palpus, lateral aspect
Fig 43 Idem, body of male from the side
Fig 44 Idem, epigynum

AMERICAN MUSEUM NOVITATES

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FOUR NEW RODENTS FROM COSTA RICA

BY GEORGE G. GOODWIN

Mr. Cecil F. Underwood, on his last field trip in December, 1942, visited Savanna de Potrero Grande in southwestern Costa Rica. The specimens secured on this trip are especially interesting since they include a splendid series of *Oligoryzomys* that provides the missing key necessary for a satisfactory study of the Costa Rican pygmy rice rats. Besides other desirable specimens, Mr. Underwood brought back a large series of an undescribed harvest mouse of the *mexicanus* group, the first specimens of this species recorded from the Pacific side of the Cordillera in Costa Rica.

I wish here to express my appreciation to Dr. W. H. Burt and Mr. William P. Harris for permission to describe a harvest mouse from Guanacaste, in the University of Michigan collections. Miss Barbara Lawrence very kindly lent me comparative material in the Museum of Comparative Zoology. Major E. A. Goldman checked over the large series of Costa Rican *Oligoryzomys* and very generously gave me the benefit of his valued opinion.

Reithrodontomys mexicanus potrero-grandei, new subspecies

TYPE: A.M.N.H. No. 142464, fully adult male, Agua Buena, locally known as Cañas Gordas but west of the real Cañas Gordas, Savanna de Potrero Grande, Costa Rica, elevation about 3500 feet, December 29, 1944; collector, C. F. Underwood. The type is a skin and skull in good condition, largest in the series; molar teeth showing some wear. Besides the type there are 14 topotypes, mostly adults.

GENERAL CHARACTERS: A very small *Reithrodontomys* of the *mexicanus* group, similar to *R. m. miniscułus* Howell from Honduras but even smaller, about the color of *R. m. cherrii* Allen but much smaller and with noticeably smaller feet.

DESCRIPTION OF TYPE: Color of upperparts bright Ochraceous-Tawny shaded with Fuscous on middorsal area, cheeks and sides of body clear bright Ochraceous-Tawny, fore and hind feet dull white with a strong median stripe of Hair Brown extending from above ankles to base of toes on hind feet, ears Fuscous, tail unicolor Fuscous, the tip white in some topotypes, a blackish ring around eye. Underparts white but stained on chest with Pinkish Buff, possibly from the juice of some fruit, the hairs dark Plumbeous at base except on chin and throat where it is white to roots. One individual in the type series is clear Ochraceous-Tawny without any shading of Fuscous on the back and has small, but distinct, pre-auricular tufts of white hairs. Skull similar in general characters to that of *R. m. cherrii* but much smaller and with smaller teeth and more globular braincase. Rostrum relatively long and slender, anterior palatine foramina moderately long and reaching posteriorly to a line across the front of the first molariform teeth, zygomatic arches somewhat constricted anteriorly; the premaxillae extending slightly beyond the posterior border of the nasals.

MEASUREMENTS OF TYPE: The average of six largest topotypes is given in parentheses. Total length, 175 mm. (178: 170–188); tail vertebrae, 111 (107: 101–114); hind foot, 18 (18: 18–18); ear, 12 (13: 13–13). Skull: greatest length, 22.5 (21.6: 21–22.3); zygomatic width, 10.8 (10.8: 10.5–11.1); width of braincase, 10.8 (10.6: 10.3–10.8); length of nasals, 8.6 (7.9: 7.8–9); width of outer wall of anteorbital foramen, 1.2 (1.25: 1.2–1.3); width of palate across first molars, 4.5 (4.3: 4.2–4.5); alveoli of upper molar series, 3 (2.9: 2.8–3).

Reithrodontomys m. potrero-grandei is clearly referable to the *mexicanus* group and is apparently the west coast representative of this species in Costa Rica. It is much smaller and distinct from the Chiriqui *R. m. garichensis* Enders, and needs no comparison with *R. dariensis* Pearson, a small species from eastern Panama and allied to the Colombian *R. milleri* Allen.

Reithrodontomys harrisi, new species

TYPE: M.Z., U.M. No. 65220, adult male, skin and skull, teeth worn, Hacienda Santa Maria, Guanacaste, Costa Rica, a large hacienda, the eastern part of which is within the cloud forest, 18 miles northeast of Liberia, altitude 3200 feet, January 27, 1932; collector, Austin Smith. The type, the only known specimen, was caught by hand on the ground in the forest.

GENERAL CHARACTERS: A small harvest mouse with relatively short bicolored tail, feet white to ankles, light-colored ears, and underparts white to roots of hair. Similar in many respects to *R. gracilis* Allen from Yucatan and *R. g. anthonyi* Goodwin from Guatemala but differing from both in brighter color and some cranial characters.

DESCRIPTION OF TYPE: Color of upperparts light Ochraceous-Tawny, sparsely mixed with dark brown hairs, paler on head and sides of body; ears drab; tail distinctly bicolored, Fuscous above, hairs white below; fore and hind feet white to wrists and ankles. Underparts white to roots of hair except for a narrow margin along sides where the fur is Plumbeous at base. Skull small, superior outline nearly straight, bullae small, zygomatic arches squared anteriorly, the sides parallel; rostrum slender, tapered anteriorly; braincase small and low, palatal foramina short, ending posteriorly slightly in front of first molars, premaxilla extending slightly beyond posterior border of nasals.

MEASUREMENTS OF TYPE: Total length, 162 mm.; tail vertebrae, 92; hind foot, 18; ear, from notch, 14. Skull: greatest length 22.1; zygomatic width, 10.5; interorbital width, 3.5; width of braincase, 10.4; width of outer wall of anteorbital foramina, 1.65; length of palatine foramina, 3.35; length of nasals, 7; alveoli of upper molar series, 2.8.

Reithrodontomys harrisi may be readily distinguished from any other species known to occur in Costa Rica by its uniform dorsal color, relatively short bicolor tail, light-colored ears, and white feet without any indication of a brown stripe extending below ankles. Compared with *R. g. anthonyi*, the most closely allied form, *R. harrisi* is smaller, the pelage Tawny instead of buffy, and the underparts are white to roots of hairs instead of being broadly Plumbeous basally. The skull of *R. harrisi* is smaller than that of *anthonyi*, with a flatter braincase, smaller bullae, and more squared zygomatic arches. Externally *R. harrisi* is not unlike *R. fulvescens chiapensis* Howell, but the resemblance is only superficial.

This species I named in honor of Mr. William P. Harris whose generosity was the means of securing this and many other desirable specimens for the Museum of Zoology at the University of Michigan.

Oryzomys fulvescens creper, new subspecies

TYPE: A.M.N.H. No. 141199, adult male, skin and skull, Volcan Irazu, Costa Rica, elevation 9400 feet, August 15, 1941; collector, C. F. Underwood. Besides the type there are 12 specimens from the vicinity of Villa Quesada and 12 from Los Higuerones, Escazu, referable to this new form.

GENERAL CHARACTERS: A relatively small, dark-colored, long-tailed *Oligoryzomys* with head and shoulders heavily overlaid with black. *O. f. creper* is smaller than *O. f. vegetus* from Chiriqui and differs from *O. f. costaricensis* from El General, not only in darker color but in having a more slender skull.

DESCRIPTION OF TYPE: Upperparts Ochraceous-Buff grading to almost Russet on rump and finely mixed with black, the black most intense on head and shoulders; cheeks and lateral line nearly clear Ochraceous-Buff; underparts white but faintly tinged with pale buff, the base of hairs Plumbeous, feet soiled white; tail brownish above, yellowish white below except toward tip which is dusky all around. Skull small and relatively narrow, rostrum slender, the sides nearly parallel, braincase small, smoothly rounded but well inflated, interorbital region especially narrow and teeth small.

MEASUREMENTS OF TYPE: Measurements of an adult male from Villa Quesada in parentheses to show extreme in variation. Total length, 197 mm. (200); tail vertebrae, 105, dry, 115 (120); hind foot, 22 (23); ear, 13 (13). Skull: greatest length, 22.9 (23.7); zygomatic width, 12 (12); interorbital width, 3.3 (3.3); width of braincase, 10.3 (10.5); length of nasals, 8 (9); anterior palatine foramina, 3.4 (3.6); palatal bridge, 3.8 (3.6); outer wall of anteorbital foramina, 1.6 (1.8); alveoli of upper molar series, 2.5 (3).

A series now available from Potrero Grande on the Rio Diquis, Costa Rica, affords a satisfactory basis for comparison and the determination of the characters of typical *O. f. costaricensis* Allen. It is apparent that this form is rather pale in color, as might be expected coming from low elevations on the western side of Costa Rica. *O. f. creper*, in addition to its characteristic dark coloration, is separable from Allen's form by its longer tail, smaller and more slender skull, more rounded braincase, and especially by the narrower interorbital space. *O. f. nicaraguae* is apparently a valid form and more closely allied to typical *fulvescens* than to *creper*. *O. f. vegetus* is decidedly larger than *creper*, with longer tail, larger hind foot, and more uniform coloration. In choosing the type I have, at Major Goldman's suggestion, selected the specimen collected at 9400 feet altitude on Volcan Irazu because mountain forms are apt to present their extreme development at high elevations. Specimens from Villa Quesada and Tabezco are typical and those from Escazu do not seem to be appreciably different.

Oryzomys fulvescens reventazoni,
new subspecies

TYPE: A.M.N.H. No. 141891, skin and skull, male adult, Sta. Teresa, 3100 feet elevation, a small town above Peralta in the lower Reventazon Valley, Province of Cartago, February 8, 1942; collector, C. F. Underwood. Besides the type there are four topotypes.

GENERAL CHARACTERS: A very small, dark-colored, pygmy rice rat. Similar in general appearance to *O. f. creper* but much smaller and tail shorter.

DESCRIPTION: Color of type very similar to that of *creper* but slightly more intense and underparts more buffy. The topotypes, however, are paler and duller colored with underparts white. Skull much smaller than that of *creper*, with a shorter and more sharply tapered rostrum; anterior palatine foramina relatively long and extending posteriorly to between the first molariform teeth. In *creper* they terminate in front of a line across the anterior border of these teeth.

MEASUREMENTS OF TYPE: Measurements of a semi-adult female in parentheses. Total length, 182 mm. (163); tail vertebrae, 103 dry (90); hind foot, 22 (20); ear, 13 (11). Skull: greatest length, 21.45 (20.1); zygomatic width, 11+ (10.5); interorbital width, 3.45 (3.4); width of braincase, 10.4 (9.7); anterior palatine foramina, 3.3 (3.3); palatal bridge, 3.7 (3.6); outer wall anteorbital foramina, 1.7 (1.5); nasals, 7.7 (7.5); alveoli of upper molar series, 2.8 (2.8).

Oryzomys f. reventazoni is a small, short-tailed form, apparently occupying the Caribbean side of Costa Rica at low elevation. While all specimens in the type series are rather young, some are breeding and show some wear on the teeth. They are all decidedly smaller than even younger individuals from higher elevation. More specimens from low elevations in eastern Costa Rica, however, are necessary to determine the extreme developments of this form.

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BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. 55[1]

NOTES ON THE BIRDS OF NORTHERN MELANESIA. 1

BY ERNST MAYR

During the years 1927 to 1935 the Whitney South Sea Expedition explored the length and breadth of the Solomon Islands and the Bismarck Archipelago. The material gathered through the industry of Rollo H. Beck, William F. Coultas, F. P. Drowne, H. Hamlin, and the other members of the expedition, together with the rich collections of the Rothschild Museum, constitutes an unparalleled representation of the bird fauna of these islands.

Part of this material has been discussed previously in many of the generic revisions of the Whitney reports. Other parts of the collection are still unworked, except for a cursory inspection in connection with the preparation of the "Birds of the southwest Pacific." It seems legitimate to unite the notes on the birds of the Solomon Islands and of the Bismarck Archipelago in a single series, in view of the great similarities of their bird faunas. "Northern Melanesia" (see Mayr, 1941, Proc. 6th Pacific Sci. Congr., 1939, vol. 4, p. 193, for a definition of this concept) is a single zoogeographic unit.

CASSOWARIES

Only a single cassowary reaches northern Melanesia, *Casuarius b. bennetti* (New Britain). The exact differences between this form and *hecki* from the opposite coast of New Guinea (Huon Peninsula) cannot be described accurately without colored sketches of the soft parts taken in the field. Cassowaries are good swimmers, and there is little doubt that *bennetti* reached New Britain by swimming. Naturally, the chances for the success of such colonizations are very slight, particularly since a pair must have bridged this water gap simultaneously. As I have pointed out previously (1940, Amer. Mus. Novitates, no. 1056, p. 1), there are no valid records of wild specimens of *C. unappendiculatus* from New Britain.

GREBES

Only two species of little grebes are found in northern Melanesia. One of these, *Podiceps novaehollandiae*, has been reviewed by me recently (1943, Emu, vol. 43, pp. 3–7). Only two of its races have so far been found in this area: *P. n. rennellianus* on Rennell Island and an unidentified subspecies in the Admiralty Islands (see Heinroth, 1903, Jour. Ornith., vol. 51, p. 88). The striking differences in the downy plumage of the two species has been described and figured recently (Mayr, 1945, Emu, vol. 44, p. 232).

The other species, *Podiceps ruficollis*, has been found in New Ireland, where it was discovered by Peekel at Namatanai (Stresemann, 1923, Arch. Naturgesch., vol. 89, div. A, no. 7, p. 7), and on Bougainville, Solomon Islands. Here it was discovered by H. Hamlin in May, 1928, and seems to be not uncommon on lakes and ponds in the hills of this island. The Bougainville population belongs to an undescribed race:

Podiceps ruficollis collaris,
new subspecies

TYPE: A.M.N.H. No. 224673; male adult; Bougainville Island; May 3, 1928; Whitney South Sea Expedition (H. Hamlin).

Similar to *P. r. tricolor* Gray, but darker throughout; upper parts deep glossy black with a greenish sheen; a broad black collar separates the rufous of the throat from the mouse gray abdomen (mottled with buffy white); black of upper throat restricted to chin, but reaching eye; extent of white on inner webs of secondaries much reduced.

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[1] The preceding 10 papers in this series are American Museum Novitates nos. 1133, 1144, 1152, 1166, 1175, 1176, 1192, 1237, 1248, and 1269.

MEASUREMENTS: Wing, male adult, 108, two females (molting). Bill, male, 25, 21.9, female, 22.3, 22.7.

RANGE: Bougainville Island, Solomon Islands, also probably New Ireland and Huon Peninsula, northeastern New Guinea.

The Whitney expedition did not encounter this species on any of the other islands of the Solomons besides Bougainville. A small series from the Huon Peninsula (Wareo, R. H. Beck), is also darker than *tricolor*, particularly on the breast, but does not have the collar as well defined as *collaris*. Stresemann (1941, Jour. Ornith., vol. 89, p. 19) has already called attention to the dark color of Huon Peninsula birds. They are perhaps best referred to *collaris*. On Sentani Lake (north New Guinea), however, occurs a population of *tricolor* which is by no means darker than birds from the Moluccas or Celebes.

A series from the Kei Islands is much lighter, both above and below; it is best included with *vulcanorum* Rensch. I fail to see the character claimed by Rensch for this race, but find that birds from the Lesser Sunda Islands are of much lighter general coloration than Moluccan birds. None of these races has an eclipse plumage. The two adult females and one adult male from Bougainville have all the wing feathers in the sheath (May 3 to 5). This shows that these tropical grebes molt all primaries and secondaries simultaneously like their northern relatives.

MATERIAL EXAMINED: *Podiceps r. vulcanorum:* 8 ad., Lesser Sunda Islands; 3 ♂ ad., 5 ♀ ad., Kei Islands. *P. r. tricolor:* 4 ♂ ad., 4 ♀ ad., Celebes; 3 ♂ ad., Buru; 1 ♀ ad., Seran; 1 ♂ ad., Morotai; 3 ♂ ad., 2 ♀ ad., north New Guinea (Sentani Lake). *P. r. collaris:* 1 ♂ ad., 2 ♀ ad., Huon Peninsula; 2 ♂ ad., 2 ♀ ad., Bougainville, Solomon Islands.

DUCKS

Whatever geographical variation occurs among the ducks of the Australian region, it affects nearly always size only. This has been shown in a number of recent revisions. For *Anas superciliosa*, see Amadon (1943, Amer. Mus. Novitates, no. 1237, pp. 1–5); for *Anas gibberifrons*, see Ripley (1942, Auk, vol. 59, pp. 90–99); for *Nyroca australis*, see Mayr (1940, Amer. Mus. Novitates, no. 1056, p. 7); and for *Nettapus coromandelianus*, see Mayr (1938, Zool. Ser. Field Mus. Nat. Hist., vol. 20, p. 464). *Dendrocygna arcuata* is to be added to this list as is evident from the subsequently listed measurements. On the whole all these species follow Bergmann's rule. None of the tropical populations are of larger size than those from subtropical Australia. However, in none of these species is there any noticeable size difference between birds from southern and from tropical Australia. The populations with the smallest size are found on islands, as *Anas superciliosa pelewensis* in Polynesia and Papua, *Anas gibberifrons remissa* on Rennell Island, *Nyroca australis extima* in the New Hebrides, *Nettapus cor. coromandelianus* on New Guinea and Malaysia, and *Dendrocygna arcuata pygmaea* on New Britain and (? subsp.) Fiji. Populations on tropical mountain lakes may have the large size of subtropical birds (*Anas superciliosa* and *Nyroca australis*).

Dendrocygna arcuata

For many years an argument has been carried on whether or not there was geographical variation in this species. Nevertheless I fail to find any paper in which a serious attempt has been made to study this question. My own investigations indicate that there are no constant color differences between the various populations of the species. The edges of the feathers of the upper parts may be more rufous or more clay colored, the spots on the breast may be larger or smaller or more like a cross bar, the under parts may be deeper or paler rufous, and the light shaft streaks on some of the scapulars may be more or less pronounced. This variation shows no geographical pattern. However, there is a striking size variation, on the basis of which I recognize three races.

Dendrocygna arcuata arcuata Horsfield

Anas arcuata Horsfield, 1824, Zoological researches in Java, pl. 65. Java.

Of medium size. A series from the Philippines measures: wing, male, 193, 194, 197, 200, female, 183, 184, 197; bill, male, 42, 42, 43, 44, female, 40, 41.5, 43.5. Professor O. Neumann sent me the following wing measurements of Philippine birds: male, 183, 198, female, 195. Kuroda lists male, 190–191, female, 183. No Java birds have been available to me, but Kuroda (1936, Birds of Java, p. 567) gives male, 192.5, adult, 190; bill, male, 40.5–45.5, female, 43, which agrees with the measurements of Philippine birds.

Birds from Celebes and the Lesser Sunda Islands, though slightly larger, are best included with this race: Celebes, wing, male, 201, 201, female, 201, unsexed, 193, 200; bill, male, 48, female, 44, unsexed, 40, 42. Sumba, male, wing, 203, bill, 43.

Range: Borneo, Sumatra, Java, Lesser Sunda Islands (Bali, Sumba, and Timor), Celebes, Amboina, Philippines.

Dendrocygna arcuata australis Reichenbach

Dendrocygna arcuata (*australis*) Reichenbach, 1850, Novitiae ad synopsin avium, no. 4, p. 4 (based on Gould, Birds of Australia, vol. 7, pl. 14). Port Essington, Northern Territory.

Dendrocygna javanica peroni Mathews, 1912, Austral Av. Rec., vol. 1, p. 86. Fitzroy River, northwest Australia.

Measurements: Large. Wing, male adult, 200, 200, 206, 208, 211, 212, 212, 215, 216, 217, 219, 220, 221, 222 (213.8), female adult, 207, 210, 210, 210, 212, 213, 215, 216 (211.6), unsexed, 209, 215, 216, 216, 218, 219. Total, 200–222 (213.5). Bill, male, 42, 42, 43, 43.5, 44, 45, 45, 45, 46, 46, 46, 47, 47; female, 42, 44, 44, 44, 44.5, 45, 45, 46; unsexed, 44, 44, 46, 46, 46, 48.5. Total 42–48.5 (44.7).

Range: Australia, rarer in the southern half; south New Guinea.

The populations from New Caledonia and northern New Guinea remain to be measured before it can be determined whether they belong to *australis* or are intermediate in size between *australis* and the smaller races of the species.

Dendrocygna arcuata pygmaea,
new subspecies

Type: A.M.N.H. No. 333686; male adult; Maulo, Wide Bay, New Britain; April 6, 1933; Whitney South Sea Expedition (W. F. Coultas).

In coloration like the other two races of the species, but much smaller. Wing, male, 173, 178, 183, female, 175, 173. Bill, male, 40.5, 42.5, 43.5, female, 40.5, 42.5.

Range: New Britain.

The extinct population from the Fiji Islands may have also belonged to this small race. A single immature male from Vanua Levu has a wing length of 176; bill, 39.

Dendrocygna guttata Schlegel

New Britain is the only island in northern Melanesia where this species occurs. Wing, male, 208, 209, 210, 212, 213, 222, female, 206, 217. A series of males from the Moluccas has a range of variation from 208–222, exactly as in the New Britain series.

There is much individual, but no geographical, variation of color. Immature birds have streaks along the flanks, like the adults of other species of *Dendrocygna*, not spots like adult *guttata*. This indicates that the spots of this simply colored species are not a primitive feature.

Herons

Most of the species of herons that occur in northern Melanesia have been revised in recent years, and nothing further needs to be said. This is true for *Demigretta sacra* (1941, Mayr and Amadon, Amer. Mus. Novitates, no. 1144), for *Nycticorax caledonicus* (1942, Amadon, Amer. Mus. Novitates, no. 1175), and for *Butorides striatus* (1940, Mayr, Amer. Mus. Novitates, no. 1056, pp. 4–7). O. Meyer (1936, Vögel des Bismarck Archipels, pp. 34, 48) lists *Butorides s. macrorhynchus* as winter "visitor from the north" for New Ireland and New Hanover. Except for this unsubstantiated reference, there are curiously no records of this species from the Bismarck Archipelago. This is particularly surprising since the species is common in western New Guinea (Geelvink Bay) and in the Solomon Islands. However, it seems to be equally rare or absent in northern New Guinea.

There are a few New Britain records of *Ixobrychus sinensis*, but this species occurs in the Bismarck Archipelago obviously only as a migrant. Coultas obtained specimens at Maulo, Wide Bay, New Britain (one male adult, two male immatures, testes small, January 10, 12, March 29) and at Ahu Island, Ninigo Group (two male adults, testes small, June 9, 11). The black bittern (*Dupetor flavicollis*) is the only member of the heron family occurring in northern Melanesia which remains to be revised.

Dupetor flavicollis

Nearly every author who has worked with this species has first emphasized the presence of considerable geographical variation but has finally ended by including all the birds of the Australian region with *gouldi*. There is no doubt that nearly every extensive series collected at a single locality is different from any other series of the species. However, this variation is so haphazard and there is so much individual variation superimposed that it will be best to follow Hartert's lead (1926, Novit. Zool., vol. 33, p. 174) and unite all these populations under a single subspecific name.

The all-black phase of the male is represented in our collections by specimens from the Aru Islands, Doini Island (southeast New Guinea), and from Witu Island. Every male (except one) from the latter island is in this phase. The whitish phase, which was originally discovered by Rev. Otto Meyer (Stresemann, 1926, Ornith. Monatsber., vol. 34, pp. 118–119), is known so far only from New Britain. Coultas collected three males and three females in this more or less albinistic plumage at Wide Bay.

Dupetor flavicollis gouldi Bonaparte

The following notes indicate the trends of geographical variation in this species.

Six adult males from New South Wales (type locality of *gouldi*) are dark sooty slate gray above. Underneath they are also rather dark. The line on the middle of the throat is composed of rufous feathers with broad black tips. A single male from Melville Island (type of *melvillensis*) and another single male from Parry's Creek (type of *disneyi*) agree in coloration with New South Wales birds. Males from mid-Queensland and from Cape York are more brownish above and on breast and throat.

Two adult females from New South Wales and four from Northern Territory are dark brownish fuscous above. They have rather little rufous in the plumage. The feathers along the middle of the upper throat are broadly tipped with black. A single female from Parry's Creek is distinctly more rufous brown, particularly on throat and breast.

A single adult female from Timor (type locality of *australis*) is a rather rufous bird. It agrees in general coloration with the female from Parry's Creek, but is paler on the upper parts. In the color of the under parts it can be matched with females from the Moluccas, north New Guinea, and New Britain. The back is somewhat paler rufous, less brownish than any of them. Still the difference is much smaller than between New South Wales females and the Parry's Creek female.

New Guinea males, on the whole, are blacker than Australian males, particularly on the breast. New Guinea females are very variable, but most of them belong to the rufous phase.

Males from Woodlark Island, the Louisiades, and the Bismarck Archipelago are the black extreme. They have very little brownish on breast and throat; the feathers along the middle of the throat are black. Some birds from the Moluccas are equally black.

Females from the Bismarck Archipelago include some very rufous specimens, similar to the Parry's Creek female; others are more gray brown and can be matched with typical New South Wales females.

As bewildering as the color variation is that of size, as illustrated in table 1. Australian birds undoubtedly have the shortest bill; those from the tropics are of rather uniform relative size.

The single female from Timor (wing, 202, bill, 68, relative bill length, 33.7) has a shorter bill than any other adult specimen. It seems advisable to recognize *australis* on this character and on the paleness of the plumage, and to unite provisionally all the other populations under the name *gouldi.*

Dupetor flavicollis is widespread in the Bismarck Archipelago. It occurs not only on the large islands but also on most of the smaller ones. I have examined specimens from Witu Island, New Britain, New Ireland, New Hanover, Feni Island, Lihir Islands, Manus (Admiralty Islands), and Ahu (Ninigo group).

Dupetor flavicollis woodfordi
Ogilvie Grant

ADULT MALE: Similar to *gouldi* male, but even blacker underneath; black streak along middle of upper throat very wide, throat and breast pure black, without rufous brown; white streaks on breast and throat scanty and narrow.

TABLE 1

VARIATION IN MEASUREMENTS OF ADULT MALES OF *Dupetor flavicollis*
(MEANS IN PARENTHESES)

	No. of specimens	Wing length	Bill (culmen from 1st feather to tip)	Relative length of bill (in per cent of wing length)
Torres Strait, including south New Guinea, Cape York, and Melville Island	7	193–214 (206.5)	71–78 (75.1)	34.6–38.0 (36.4)
Bismarck Archipelago	10	201–215 (208.8)	72–85 (77.3)	34.1–40.4 (37.2)
Idenburg River, north New Guinea	8	206–222 (214.4)	80–86 (81.9)	36.4–40.3 (38.2)
Sentani Lake, north New Guinea	8	204–225 (217.1)	73–82 (79.2)	33.3–38.7 (36.5)
Moluccas	4	211–227 (219.0)	80–86 (82.6)	36.3–37.8 (37.2)
Eastern New Guinea	5	215–230 (220.2)	80–83 (82.0)	35.7–38.6 (36.8)
New South Wales	6	217–226 (222.0)	71–82 (77.0)	31.4–36.7 (34.7)

ADULT FEMALE: Very different from female *gouldi;* upper parts a bright tawny rufous; crown, wings, and tail slate gray; under parts buffy ochre with a line of small black dots along the middle of upper throat.

MEASUREMENTS: Wing, male adult, 192 (Tetipari), female, 182, 190, 186 (Guadalcanal, Ulawa), 198, 200, 207 (Vangunu, Choiseul, Vella Lavella). Bill (same sequence of specimens), male, 78, female, 70, 71, 76, 77, 76, 79; bill index, male, 40.6, female, 38.5, 37.3, 40.8, 38.9, 38.0, 38.1.

Two females from Rennell Island are paler than the Solomon Islands series. They have been described as *pallidior* (Mayr, 1931, Amer. Mus. Novitates, no. 486, p. 5). Additional material from Rennell is required to substantiate the validity of this form. A female from Ulawa (eastern Solomon Islands) is nearly as pale as the Rennell specimens.

HAWKS

The taxonomy of many of the hawks of northern Melanesia is uncomplicated. This is true for some of the widespread species, like *Haliaeetus leucogaster* (Bismarck Archipelago), *Pandion haliaetus melvillensis* (see Amadon, 1941, Emu, vol. 40, pp. 375–377), or *Haliastur indus girrenera* (see Hartert, 1929, Amer. Mus. Novitates, no. 364, p. 2). It is also true for some of the well-defined, localized endemic species and races, such as *Haliaeetus sanfordi* (see Mayr, 1936, Amer. Mus. Novitates, no. 828, pp. 1–3), *Accipiter (gentilis) meyerianus* (see Mayr, 1934, Amer. Mus. Novitates, no. 709, pp. 1–2), *Accipiter princeps* (see Mayr, 1934, Amer. Mus. Novitates, no. 709, pp. 3–4), *Accipiter brachyurus* (New Britain), and *Henicopernis longicauda fuscatus* (New Britain). The species *luteoschistaceus* and *eichhorni* will be discussed in a forthcoming revision of the superspecies *Accipiter rufitorques.* The geographical variation of the following three species is, however, still insufficiently described.

Accipiter novaehollandiae

This widespread species breaks up into numerous races. Hartert (1929, Amer. Mus. Novitates, no. 364, pp. 4-5) has described the geographical variation in the Solomon Islands. His account is correct except for the fact that the Florida group is inhabited by *rufoschistaceus* (not by *pulchellus*). To the four races known to Hartert an endemic Malaita race (*malaitae*) is to be added (see Mayr, 1931, Amer. Mus. Novitates, no. 504, p. 4). Curiously the species is absent from San Cristobal and surrounding islands. The white phase, which is present in the Australian races and in some of those of the New Guinea area (see Mayr, 1940, Amer. Mus. Novitates, no. 1056, pp. 9-11), is absent in northern Melanesia.

Very little work has so far been done on the taxonomy of this species in the Bismarck Archipelago. In 1913 Rothschild and Hartert received two males from Rook Island. At the time they had virtually no material from New Britain (the type locality of *dampieri*) but many specimens from Manus, New Hanover, and New Ireland. The Rook Island birds were much smaller than these and were therefore separated by them as *rooki* (1914, Novit. Zool., vol. 21, p. 288). In 1926 when these authors received a good series from Talasea, New Britain, they realized that there was no size difference between New Britain and Rook Island birds and placed their own *rooki* as a synonym of *dampieri* (1926, Novit. Zool., vol. 33, p. 128). They mentioned that different races might be described from Manus and St. Matthias.

In 1933 Stresemann received two specimens from the Lihir Islands and described the strikingly distinct race *lihirensis* (Stresemann, 1933, Ornith. Monatsber., vol. 41, p. 114). Since then the American Museum of Natural History has not only acquired the Rothschild Collection but has also received an unparalleled series of specimens from many islands in the Bismarck Archipelago through the diligence of William F. Coultas. A study of this material shows that the following forms of the species can be distinguished in the Bismarck Archipelago.

Accipiter novaehollandiae dampieri Gurney

Urospizias dampieri GURNEY, 1882, Ibis, p. 453. New Britain.

ADULT MALE: Rather similar to *leucosomus*, but middle of upper throat pale rufous, more distinctly contrasting with the gray sides of the throat. Upper parts much lighter gray. Rufous of under parts lighter and more pinkish. Thighs and under tail-coverts much lighter, the latter sometimes white. Seven of 25 males with a faint barring of the under parts, particularly the flanks. Differs from the Solomon Islands races by the much lighter, less rust-colored under parts and by the pink, not gray, throat. Upper parts also lighter.

ADULT FEMALE: Much larger and darker. More often barred underneath. Only four of 38 females without bars. Nineteen with very conspicuous bars. Differs from female *leucosomus* by being more reddish, less rusty underneath, by having no gray on the lower throat, by having the middle of the upper throat rufous, and by being grayer and lighter above. Differs from Solomon Islands races as the male. Differs from the female of *malaitae* by having a much lighter gray of upper parts and sides of head, and a less conspicuous barring of the breast.

IMMATURE FEMALE: Under parts with regular well-defined cross bars. Crissum and under tail-coverts white with few bars. Thighs pale rufous. Middle of upper throat with heavy gray brown streaks. Upper parts slaty brown, tail with faint bars, head darker. Very different from *leucosomus* and the other New Guinea races which lack the regular barring of the under parts. Fairly similar to the Solomon Islands races but barring heavier and more suffused with rufous. Barring on lower abdomen and crissum more pronounced.

IMMATURE MALE: Less heavily barred than female, lower abdomen whitish. Thighs paler, bars of under parts usually more rufous. A rufous collar across upper back sometimes indicated.

MEASUREMENTS: Wing, male adult, 188–197 (193.3) [New Britain], 190, 195 [Rook], male immature, 186–198 (192.3), female adult, 212–234 (224.5), female immature, 218–231 (222.8). Tail, male adult, 135–145 (140.2), male immature 140–149, female adult, 155–176 (165.2), female immature, 160–171.

Range: New Britain, Rook Island.

A single immature male from the Talele Islands is very small (wing, 186) and less heavily marked than any of the mainland birds.

Accipiter novaehollandiae lavongai, new subspecies

Type: A.M.N.H. No. 532872, Rothschild Collection; New Hanover (Lavongai); February 9, 1923; A. F. Eichhorn.

Similar to *A. n. dampieri* but much larger. Wing, male immature, 211, against 186–198 in *dampieri;* tail, 153, against 140–149; female immature, wing, 245, 253, against 218–231 in *dampieri;* tail, 178, 194, against 160–171. Bars on each feather of under parts of male rather short, often reduced to an arrow-shaped spot. Thighs pale rufous. Immature female rather heavily barred underneath, and one of the two females with a prominent rufous wash.

Range: New Hanover (Lavongai), (?) New Ireland, (?) Tabar group.

The taxonomic position of the New Ireland population is still obscure. An immature male from the southern tip of New Ireland is rather light underneath with rufous, somewhat ill-defined barring. This specimen does not differ materially from a few extreme birds in the New Britain series. An adult male and an immature female from the Curtis collection are reputed to have come from "? New Ireland." They are old, poorly made skins and do not seem to show any striking differences from the New Britain series, and they may well be from that island. The male is rather large, and the bars on the under parts of the female are rather rufous. These New Ireland specimens measure as follows: wing, male adult, 201, male immature, 204, female immature, 229. Tail, male adult, 144, male immature, 153, female immature, 164. More New Ireland material needs to be examined.

A series of birds from Tabar Island, Tabar group, differs from *lihirensis* in the adult plumage by lacking the barring of flanks and under tail-coverts. The single immature female agrees in coloration tolerably well with one of the two immature *lavongai.* The bars, however, are somewhat more rufous, less blackish. There is little of a general rufous wash on the under parts. Until adults of *lavongai* and more immatures from Tabar are available, it will be best to unite the two populations under the name *lavongai.*

The measurements of the Tabar population are as follows: wing, male adult, 221, 222, 225, 228, male immature, 219, female adult, 254, 256, 258, 260, female immature, 248. Tail, male adult, 154, 157, 158, 159, 160, male immature, 159, female adult, 187, 188, 192, 193, female immature, 186. This indicates that Tabar birds average larger than Lavongai specimens.

Accipiter novaehollandiae lihirensis Stresemann

Accipiter novaehollandiae lihirensis Stresemann, 1933, Ornith. Monatsber., vol. 41, p. 114. Lihir, Lihir Islands.

A very large and dark race.

Adult Female: Similar to *dampieri* but with more gray on the upper throat. Breast and abdomen deep rusty rufous. Upper parts darker gray. Lower flanks and under tail-coverts with regular rufous and white bars.

Adult Male: Very similar to adult female but with the barring of flanks and under tail-coverts obsolete. Middle of upper throat often grayish. Somewhat similar to the Solomon Islands races but darker slate gray above and the red of the under parts of a different shade, more deep vinaceous rather than rusty rufous.

Immature: Very densely barred with rufous underneath, approaching the adult coloration. Crissum and under tail-coverts white with obsolete barring. Upper throat with dense brownish gray streaking. Upper parts dark slaty brown. The bars of the under parts are a little coarser and the white bars more conspicuous in the males.

Measurements: Wing, male adult, 212–232 (219.7), male immature, 211, 211, female adult, 252–263 (256.2), female immature, 247, 248, 251, 259. Tail, male adult, 153–168 (158.8), male immature, 154, 155, 157, female adult, 184–198 (188.7), female immature, 180–186 (182.6).

RANGE: Lihir group (Lihir, Mahur, Malie, Sinabiet, Masahet) and Tanga Islands (Boang).

Accipiter novaehollandiae matthiae, new subspecies

TYPE: A.M.N.H. No. 532870, Rothschild Collection; St. Matthias Island; July 7, 1923; A. F. Eichhorn.

ADULT MALE: Similar to *lihirensis* but smaller and upper parts less dark, more like *dampieri*. Thighs and under tail-coverts deep rufous like the rest of the under parts. The immature female differs from *dampieri* by having the entire under parts washed with rufous and from *lihirensis* by having the cross bars more blackish and better defined. The under tail-coverts are pale rufous.

MEASUREMENTS: Wing, male adult, 202, female immature, 235. Tail, male adult, 150, female immature, 181.

RANGE: St. Matthias Island.

Accipiter novaehollandiae manusi, new subspecies

TYPE: A.M.N.H. No. 335324; male immature; Lombrum, Manus, Admiralty Islands; July 26, 1934; Whitney South Sea Expedition (W. F. Coultas).

Similar to *dampieri* but larger and darker. Adult females never barred underneath. Upper parts darker gray. Under tail-coverts deep rufous like the rest of the under parts. Adult males differ likewise by being of larger size and darker colored. Barring always absent. Under tail-coverts usually paler than remainder of under parts. Immature females are very different from immature *dampieri*. The barring of the under side is much less pronounced and more irregular. Sometimes the bars are resolved into irregular spots. The upper throat is whitish. Barring of the tail seems to be more pronounced. Immature males are even less marked underneath. Two of three males are pure buffy white underneath with a faint indication of a few shaft streaks. The upper parts similar.

A single immature female from Rambutyo Island is more heavily marked than two Manus females; a single immature female from Nauna is buffy white underneath with a few drop-shaped spots.

MEASUREMENTS: Wing, male adult, 198–213 (203.7), male immature, 199, 202, 204, female adult, 235, 235, 239, female immature, 227, 233, 237. Tail, male adult, 143–154 (147.3), male immature, 138, 143, 146, female adult, 170, 170, 176, 178, female immature, 172, 174, 176. A single immature female from Nauna Island is rather small (wing, 217, tail, 168).

RANGE: Manus, San Miguel, Rambutyo, Nauna, Admiralty Islands.

THE RACES OF *Accipiter albogularis* IN THE SOLOMON ISLANDS

Recent revisers, as Hartert (1929, Amer. Mus. Novitates, no. 364, p. 3) and Peters (1931, Check-list of birds of the world, vol. 1, p. 218) list *Accipiter albogularis* as a monotypic species, occurring throughout the Solomon Islands. This is not correct, since *sharpei* Oustalet (Santa Cruz Islands) is clearly conspecific (Mayr, 1945, Birds of the southwest Pacific, p. 202). On the Solomon Islands also the species is divided into three races, the detailed description of which will be published in a forthcoming revision of the superspecies *Accipiter rufitorques*. The three races are apparently indistinguishable in the adult plumage, but are very marked in the immature plumage. They are: *albogularis* Gray (San Cristobal, Ugi, Santa Anna), *woodfordi* Sharpe (Guadalcanal, Florida, Choiseul, Treasury, Bougainville), and an undescribed race from the central Solomon Islands. As first reviser, I choose the name *woodfordi* for the Guadalcanal race in preference to the misleading name *holomelas*, in accordance with Article 28 of the International Rules. Both names were published simultaneously by Sharpe who himself expressed preference for the name *woodfordi*.

Accipiter albogularis gilvus, new subspecies

TYPE: A.M.N.H. No. 533349, Rothschild Collection: male immature; Kulambangra, Solomon Islands; March 12, 1901; A. S. Meek.

Immatures differ from those of *woodfordi* by being much less heavily marked underneath. The streaks on the chest are narrower; the under wing-coverts are almost unmarked. The feathers of the thighs are marked with narrow, dark brown shaft streaks, while in *woodfordi* the markings are rufous and arrow-shaped. The ground color of the under parts is deeper, pale ochraceous, not buffy white. The two adult males are white bellied but lack the rufous collar. Size as in *woodfordi*.

Range: Vella Lavella, Kulambangra, New Georgia, and Rendova.

Specimens Examined: *A. a. albogularis*, 3 ad., 6 imm.; *woodfordi*, 13 ad., 12 imm. (including one each from Mus. Comp. Zoöl. and Zool. Mus. Univ. Michigan); *gilvus*, 2 ad., 3 imm.

The Races of *Aviceda subcristata* in Northern Melanesia

The splendid new material collected by the Whitney South Sea Expedition permits the undertaking of the long needed revision of the populations of this species on the islands northeast of New Guinea. Not even the named races of the area (*gurneyi*, *bismarcki*) have been adequately described previously. The New Guinea races were discussed by me recently (1940, Amer. Mus. Novitates, no. 1056). Tail index in the following lists of measurements indicates relative length of tail, expressed as a percentage of the wing length. Tail tip indicates length of the black tip of the tail, expressed as percentage of total length of tail. In the Solomon Islands three races occur which are very similar to one another.

Aviceda subcristata gurneyi Ramsay

Baza Gurneyi Ramsay, 1883, Jour. Linnean Soc., London, vol. 161, p. 130. Ugi (restricted type locality) and "Cape Pitt" (by error).

Adult Male: Similar to *stenozona*, but breast and belly purer white; pale rufous-ochre more clearly restricted to crissum and under tail-coverts; bars across breast and abdomen blackish slate gray without any brownish tinge; under wing-coverts more whitish; top of head averaging much paler gray; brownish parts of plumage (back and scapulars) more distinctly suffused with gray; subterminal black bars on tail ill defined, often only indicated as a dark gray band.

Female: Similar to male and approximately of the same wing length; tail longer; terminal tail bar (black tip) shorter; upper tail-coverts more brownish; subterminal dark tail bars browner and more clearly defined; bars of breast and abdomen narrower, more brownish black, not grayish black.

Immatures are characterized by the narrow pale margins of the feathers of back and wing-coverts, by the narrower tail feathers, by the whitish buff admixture to the gray of the throat, by the more pronounced blackish line in the middle of the throat, and by the scantier barring of breast and abdomen. The differences between the sexes and age classes are the same in all three races from the Solomon Islands.

Measurements: Wing, male adult, 304 (San Cristobal), 298, 300 (Guadalcanal), female adult, 317 (Santa Anna), 301 (Guadalcanal). Tail (same sequence of specimens), male, 185, 175, 180, female, 197, 185. Tail index, male, 60.8, 58.3, 60.4, female 62.2, 61.4. Tail tip, male, 48.1, 37.1, 43.8, female, 40.1, 37.3.

Range: San Cristobal, Ugi, Santa Anna, Malaita, and Guadalcanal.

Unfortunately not a single good series of adults from any of these islands is available for examination. Ramsay (1882, Proc. Linnean Soc. New South Wales, vol. 7, p. 32) had six specimens from Ugi, but does not describe them in detail. The single female from Santa Anna is exceptional in the almost complete obliteration of the barring of the under parts, as mentioned by Hartert (1929, Amer. Mus. Novitates, no. 364, p. 2). A single immature from Malaita likewise shows only little barring. Specimens from Guadalcanal are fairly well barred on breast and abdomen, but barring is reduced on the axillaries. The population from this island is somewhat intermediate between *gurneyi* and the two western races.

Aviceda subcristata robusta,
new subspecies

Type: A.M.N.H. No. 228276; male adult; Mt. Maitombi, Choiseul; October

26, 1929; Whitney South Sea Expedition (E. Mayr).

Similar to *gurneyi*, but larger; under parts, particularly of females, more heavily barred; axillaries of males always barred; under tail-coverts averaging deeper ochraceous.

MEASUREMENTS: Wing, male adult, 300, 313, 315, 322, female, 309, 310, 320, 321, 322, 324. Tail, male, 179, 182, 187, 189, female, 191, 197, 197, 200, 200, 205. Tail index, male, 57.8, 58.7, 59.7, 59.7, female, 61.4, 61.6, 62.1, 62.4, 63.3, 63.7. Tail tip, male, 40.7, 42.8, 44.5, 48.1, female, 28.4, 30.2, 33.0, 33.4, 34.0, 34.5.

RANGE: Choiseul and Ysabel, Solomon Islands.

Aviceda subcristata proxima, new subspecies

TYPE: A.M.N.H. No. 220633; male adult; Kieta District, Bougainville, Solomon Islands; January 11, 1928; Whitney South Sea Expedition (H. Hamlin).

Very similar to *robusta*, but smaller and less heavily barred underneath, tail slightly longer.

MEASUREMENTS: Wing, male adult, 290, 292, 293, 295, 297, female adult, 291, 291, 292, 297. Tail, male, 174, 179, 180, 180, 181, female, 182, 184, 186, 187, 188. Tail index, male, 60.0, 60.7, 60.9, 61.4, 61.7, female, 62.3, 63.3, 63.3, 63.9. Tail tip, male, 39.1, 44.3, 44.7, 45.6, 47.2, female, 29.1, 34.4, 35.3, 35.8, 37.2.

RANGE: Bougainville and Shortland Island, Solomon Islands.

In the central Solomon Islands and on the Russell Islands a population occurs which is somewhat intermediate between *robusta* and *proxima*, both in size and in the width of the bars of the under parts. In size, however, all specimens except two from Rendova are closer to *proxima*. It is, therefore, advisable to associate them with that subspecies.

MEASUREMENTS: Wing, male adult, 298 (Bagga), 296, 300 (Gizo), 289 (New Georgia), 298, 308 (Rendova), 302 (Russell), female adult, 297 (Vella Lavella), 301, 312 (Rendova). Tail (same sequence of specimens), male, 177, 179, 177, 174, 178, 185, 185, female, 183, 186, 195. Tail index, male, 59.4, 60.4, 59.0, 60.2, 59.7, 60.1, 61.2, female, 61.7, 61.8, 62.5. Tail tip, male, 49.2, 44.2, 46.8, 44.8, 44.9, 44.3, 45.4; female, 32.8, 33.3, 34.3.

Aviceda subcristata bismarckii Sharpe

Baza bismarckii SHARPE, 1888, *in* Gould, Birds of New Guinea, pt. 25, text to plate. New Ireland.

ADULT MALE: Strikingly different from *gurneyi-proxima*. Bars of under parts pigeon gray, hardly darker than throat; white bars much narrower than gray bars, nape and upper back very pale gray; under tail-coverts deep ochraceous.

FEMALE: Breast and abdomen very heavily and coarsely barred with brownish black; under tail-coverts rufous ochre; throat dark gray; upper tail-coverts and tail-bars rather blackish gray; black tail tip very long; greater under wing-coverts barred with gray, lesser under wing-coverts ochraceous.

MEASUREMENTS: New Britain. Wing, male adult, 299–320 (309.8), female, 306–329 (316.5). Tail, male, 169–195 (183.4), female, 185–203 (193.9). Tail index, male, 56.5–62.0 (59.1), female, 60.0–62.7 (61.5). Black tail tip (in imm.) male, 80–103 (89.0), female, 70–97 (80.6). Tail tip (in per cent), male, 45.0–53.4 (48.8), female, 36.4–49.5 (41.6). Adult males from the mountains (not included in above measurements) average large: wing, 317, 323. A small series from New Ireland and New Hanover likewise seems to average rather large (at least in the wing). Wing, male adult, 314, 317, 319, 328; female adult, 322, 331+. Tail, male, 176, 184, 185, 189, female, 192, 194. Tail index, male, 56.0, 56.1, 58.4, 59.3, female, 57.8, 60.2. Black tail tip (in imm.), male, 68, 77, 82, 91, female, 72, 75. Tail tip (in per cent), male, 38.1, 40.7, 44.6, 49.2, female, 37.1, 39.1.

RANGE: New Britain, Duke of York Islands, New Ireland, and New Hanover.

The characteristics of this striking race, particularly the strong sexual dimorphism of coloration and the grayness of the bars in the male, are already indicated in the races of the Solomon Islands. On the other hand, *bismarckii* seems to have nothing to do with *megala* of the opposite coast of New Guinea. It is, therefore, very probable that the Bismarck Archipelago was colonized by birds from the Solomon Islands.

Aviceda subcristata coultasi, new subspecies

TYPE: A.M.N.H. No. 325323; male adult; Lombrum, Manus Island, Admiralty Islands; July 25, 1934; Whitney South Sea Expedition (W. F. Coultas).

ADULT MALE: Similar to *megala* in size and general coloration, but paler gray on the throat and upper back; bars of breast and abdomen broader, deep brownish black, greater under wing-coverts with faint gray bars; black tail tip longer and tail relatively much shorter. Females also paler gray on throat and upper back, bars on under parts coarser and more blackish.

TABLE 2

MEASUREMENTS OF WING AND TAIL IN *Falco severus papuanus*

	Celebes	Moluccas	New Guinea	New Britain	Solomon Islands (Gizo)
Wing					
♂ ad.	209		216, 217, 221		
♂ imm.		209	210, 214	215, 215	
♀ ad.	231, 242	240	228, 237, 238	227, 236	226
♀ imm.			230	234, 235, 240	
Tail					
♂ ad.	97		95, 96, 100		
♂ imm.		94	94, 97	95, 98	
♀ ad.	108, 111	108	101, 103, 104, 104, 107	104, 105, 106, 107, 107	97
♀ imm.			107	108, 109, 114	

MEASUREMENTS: Wing, male, 304, 307.5, female, 317. Tail, male, 176, 178, female, 184. Length of tail tip (in mm.), male, 79, 83, female, 70. Relative tail length, male, 57.2, 58.5, female, 58. Tail tip (per cent), male, 44.4, 47.2, female, 38.0.

RANGE: Known only from Manus (Drabui, Lombrum, Petaiya), Admiralty Islands.

It gives me great pleasure to name this new bird in honor of its discoverer, William F. Coultas. The similarity with *megala* indicates clearly that the Manus population is not derived from *bismarckii* but was established by an invasion from northern New Guinea.

FALCONS

Only two falcons are found in the area. I have recently discussed what is known about the geographical variation of the peregrine falcon in the Papuan region. (Mayr, 1941, Amer. Mus. Novitates, no. 1133, pp. 1–2). *Falco peregrinus ernesti* Sharpe is known from New Britain, and Otto Meyer lists it also from New Ireland (1936, Vögel des Bismarck Archipel, p. 48). This is perhaps a mistake, because on page 35 of the same volume it is recorded only for New Britain. The peregrine falcon has not yet been found in the Solomon Islands, perhaps for lack of suitable cliffs. On August 19, 1929, I observed a falcon at Soraken, northern Bougainville, which was chasing small lories (*Vini placentis*). At the time I thought it was a peregrine, but I am now inclined to believe that it might have been a hobby. I saw the black cheek patch clearly, but lost sight of the bird too quickly to record any other identification marks.

Falco severus papuanus Meyer and Wiglesworth

After comparison of a considerable series of specimens from Celebes, the Moluccas, New Guinea, New Britain, and the Solomon Islands, I have come to the conclusion that geographical variation is negligible within this area. This agrees with the findings of Siebers (1930, Treubia, vol. 7, suppl., pp. 228–234). There is a certain amount of individual variation concerning the intensity of the rufous brown of the underparts, the whiteness of the throat, and the spotting of the breast. Birds in the first adult plumage may have more spotting on breast and under wing-coverts than older birds. The single specimen from the Solomon Islands is rather small.

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NEW GENERA AND SPECIES OF ITHOMIINAE (LEPIDOPTERA, NYMPHALIDAE)

By Richard M. Fox

Mr. Frank Martin Brown sent me the Ithomiinae from his Ecuadorian collection, with the request that I study them and pass them on to the American Museum of Natural History for permanent deposit. Based on this study, three new genera and 12 new species and subspecies are presented here. All the type material is from Ecuador and, except as otherwise noted, from the Brown collection; holotypes and allotypes, except as otherwise noted, are in the American Museum of Natural History; paratypes are in the American Museum of Natural History, Academy of Natural Sciences of Philadelphia, Carnegie Museum, Instituto Oswaldo Cruz, Museum of Comparative Zoölogy, Reading Public Museum, and United States National Museum.

This paper is being published while I am in the Navy "somewhere in the Pacific." I am sincerely indebted to those who have helped prepare for publication my rough original material. Especially kind in this respect have been Dr. Walter Sweadner of the Carnegie Museum, and Miss Annette L. Bacon and Miss Alice Gray of the American Museum. And in this, as in all other projects on which I embark, my wife has functioned as my *alter ego.*

Melinaea idae vespertina, new subspecies

Figure 21

Haensch (1909, *in* Seitz, Macrolepidoptera of the world, vol. 5, p. 124) noted that the Ecuadorian race of *Melinaea idae* C. and R. Felder varies from the Colombian race in its narrower hindwing margin and smaller size. In itself this may appear trivial. However, a large series of both sexes in the Brown collection from the Pacific drainage has enabled me to make a comparison with a good series from Colombia in the Mengel collection at the Reading Public Museum. The differences are more numerous than mentioned by Haensch and are perfectly consistent. This form is found only in western Ecuador. No representative of the species has been recorded from the Oriente region.

Male and Female: Like *idae idae* except as follows. The black margins of the hindwings are strikingly narrower, being 5 to 7 mm. wide at M_3, as compared to a width of 9 to 12 mm. in *idae.* Furthermore, the proximal boundary of this border is clean cut and definite, while in *idae* it is ill defined and obscured by a median band of black brown scaling which suggests the more definite median band of the "Lycorea pattern"; in *vespertina* this scaling is wholly wanting, the tawny ground color being clear and clean. The expanse of the forewing is less, 75 to 80 mm. as compared with 80 to 85 mm.; the apex is more acute. The yellow postmedian spot of the forewing at M_3-Cu_1 is tiny, vestigial, or wanting; in *idae* it is always well developed and definite. As a general rule the black wedge-shaped spot in the forewing cell is prolonged nearly to the base under the median in *vespertina;* in *idae* this spot is chunkier and not prolonged basad. On the forewings beneath, the orange tawny below Cu_2 in *vespertina* extends to the edge of the yellow spot in the anal angle; in *idae* the yellow anal angle spot is surrounded by black.

Type Material: Holotype, male, Playas de Juan Montalvo, Los Rios, Ecuador, 30 meters, March, 1938. Allotype, female, topotypic, March 14, 1938. Paratypes: 55 males and 15 females, topotypic; six males and one female, Santo Domingo de los Colorados, Pichincha; 12

males and five females, Palmar, Manabi; two males and two females, Balzapamba, Bolivar; two males, Huigra, Chimborazo (Rhoades); one male, Hacienda Cutuguay, Chimborazo (Coxey).

Ithomia diasia browni, new subspecies

Figures 1, 26

A small series from the Brown collection captured on the Pacific slopes appeared to be *Ithomia diasia* Hewitson but upon comparison with a set of specimens from Colombia in the Reading Public Museum turned out to be undescribed; no doubt it is mixed with *diasia* in collections.

Male and Female: *Ithomia diasia browni* is a little smaller than *diasia diasia* in both sexes, the forewing apices are slightly less acute, the black margins and the discocellular and cell bands are noticeably thinner. On the underside, *diasia* has tawny only in the outer half of the hindwing costal margin, all other margins and bands being black, and the white dots in the borders are wider and tend to be round; *browni* has the tawny on the outer half of the hindwing costal margin also, but there is a rich red brown scaling along the inner edge of the forewing distal margin, in the discocellular and cell bands, and along the inner edge of the hindwing distal margin, and the white spots in the border are narrow and elongated.

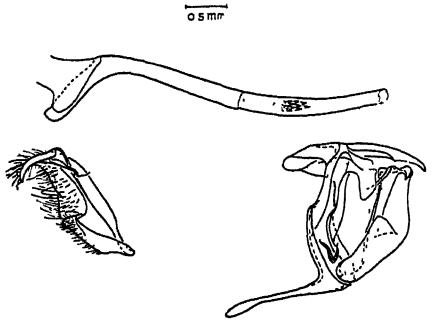


Fig. 1. *Ithomia diasia browni*, dissection of male genital armature. (Drawn by Alice Gray.)

This subspecies is named for Mr. Frank Martin Brown.

Type Material: Holotype, male, Palmar, Manabi, Ecuador, 200 meters, April 4, 1941 (genitalia slide 435). Allotype, female, Santo Domingo de los Colorados, Pichincha, Ecuador, 500 meters, January 1, 1941. Paratypes: one male, Palmar, Manabi; one female, Santo Domingo de los Colorados, Pichincha; one male, Rio Toachi, Pichincha; one male and one female, Morro-Morro, near Piñas, El Oro; six males, Dos Puentes, Chimborazo (Coxey); one male, Hacienda Cutuguay, Chimborazo (Coxey); two males, Ecuador (von Hagen).

The Whymper record of *Ithomia diasia* from Chimbo cited by Campos (1921, Rev. Colegio Nac. Vicente Rocafuerte, no. 4, p. 20; and 1927, *ibid.*, nos. 27–28, p. 9) probably is this form.

Hypothyris meterus zephyrus, new subspecies

Figure 28

The species as a whole may be recognized by the two light spots near the margin of the forewing, M_3–Cu_1 and Cu_1–Cu_2; these are in the submarginal position, but the persistence of these two only, with the loss of the others of the series, suggests that they probably are admarginal rather than submarginal. This is the first record of *H. meterus* Hewitson west of the divide. It has the yellow postdiscal band of *H. m. deëmae* Fox, but it is wider, the distad projection over M_2 especially being deeper and rounded. The forewings of *zephyrus* are a little broader, the apex is blunter.

Female: Forewing above and below agrees closely with *deëmae*, especially with the paratype from eastern Ecuador now in the United States National Museum. The postdiscal yellow band is wider, being fully 7 mm. wide along M_2, as compared to 5 mm. or less in *deëmae*, and the projection along this vein in *zephyrus* is broadly rounded, rather than pointed. There is yellow scaling below Cu_2 at the end of the black comma mark, which here is nearly as broad at its proximal end as at the margin, thus being rectangular rather than wedge shaped. The two yellow submarginal dots characteristic of this species are present, strong; there are vestigial submarginal dots at R-M_1 and M_2-M_3, especially visible beneath. Hindwing above with distal margin narrowly tawny from the apex; a black bar over the upper part of the cell and below Sc; a black median band beginning in the middle of M_2-M_3 and extending nearly to the inner margin just below the cell, both sides of it denticulate. A black submarginal series, of which only the first spot, M_3-Cu_1, is isolated, the others connected with the marginal line; Cu_1 remains tawny nearly to the margin, however. Remainder of the wing tawny. Hindwing beneath similar, the black markings stronger; two additional black spots, one beyond the end of the cell opposite the black costal bar, as in *meterus meterus*, and a small narrow streak in the cell opposite M_3-Cu_1, as in *deemae;* costal margin narrowly tawny; a small yellow spot over the base of the humeral vein. Antennae and body colors as in *deëmae*.

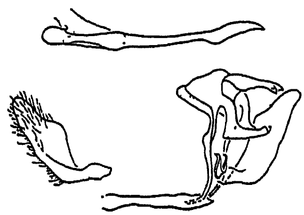


Fig. 2. *Ceratinia bisulca*, dissection of male genital armature. (Drawn by Alice Gray.)

Type Material: Holotype, female, Rio Toachi, Pichincha, Ecuador, 800 meters, November, 1939.

Ceratinia bisulca, new species

Figures 2, 3, 27

Male: No doubt this has passed heretofore as *C. callichroma* Staudinger, which it closely resembles. The yellow postmedian fascia of the forewing is wider than in *callichroma;* its distal edge is bowed so that it is wider in the middle, and it extends into the anal angle below the comma mark. In *callichroma* the narrower yellow fascia has a nearly straight distal edge, not being wider in the middle than at the costa, and the lighter color beneath the comma mark is tawny, not yellow. The black median band of the hindwing is composed of a series of dentate spots centered on the veins and pointing anteriorad, and the basal area within this band is slightly more transparent and is tinged faintly with yellow, somewhat as in *C. nise* Cramer. In *callichroma* the spots of the median band are heavier, while their points are directed posteriorad, the anterior edge of the band being straight. The hindwing beneath bears a series of tiny white spots placed in the black triangles of the border, as in most *Ceratinia* species. *C. bisulca* is entirely semitransparent, even to the black apices of the forewings, fully as transparent as *C. singularis* Rebel, and decidedly more so than *callichroma* or *C. poecila* Bates. *C. bisulca* was found flying with these last two species. The genitalia are remarkable for the cleft, laterally bifid uncus. This character, which at first I took to be an individual freak, is present in every slide I have made of the species, but has not been observed in any other *Ceratinia*.

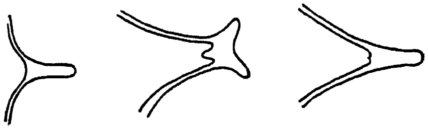


Fig. 3. *Ceratinia bisulca*, center figure of bifid uncus compared with unci of other species. (Drawn by R. M. Fox.)

I have seen no females. These should be recognizable by the peculiarities of the hindwing median band and the light fascia across the forewings.

Type Material: Holotype, male, Huagra-yacu, Oriente [Napo-Pastaza], Ecuador, 900 meters, April 8, 1941 (genitalia slide 404). Paratypes: two males, topotypic; one male, Puyo, Napo-Pastaza; one male, between Chupientsa and Rio Tayusa, Rio Upano, Santiago-Zamora; one male, Zumbi, Rio Zamora, Santiago-Zamora; one male, Mayaico, Rio Nangarico, Santiago-Zamora.

A Note on the *Dircenna* Complex

Figure 4

According to the male genitalia, as well as venation, *Dircenna* Doubleday must be limited to those species with a relatively shorter penis (two and one-half to one and two-thirds the length of the tegumen plus uncus), the proximal end of which is bilobed and which lacks a subterminal spine. I have examined preparations of the following forms belonging to *Dircenna: jemina, euchytma, bairdii, suna, loreta, olyras, relata, calverti, klugii, dero, zelie, varina visina, vandona,* and *xanthophane.* The females of all of these have four-jointed tarsi on the foreleg. Thus, Schatz's definition of the genus (1892, *in* Staudinger and Schatz, Exotische schmetterlinge, vol. 2, pp. 95–96) is strengthened by the male genitalia.

The species placed in *Callithomia* and *Corbulis* (= *Epithomia*) and some residue species generally placed in *Dircenna* may be distinguished from *Dircenna* proper by the relatively longer penis (two and one-half to four times the length of the tegumen plus uncus), having the proximal end rounded and possessing a subterminal spine near the distal end. The females all have the five-jointed fore tarsus. This block of forms may be divided into two groups of less than generic value: (1) Penis with weaker subterminal spine short, not much more than a little tooth. These are included: *alexirrhoë, alpho, agrippina, butes, infuscata, hezia, hedila, tridactyla, megaleas,* and *beronilla.* (2) Penis with strong subterminal spine, about one-third the length of the costa of the valve. These are included: *xantho, methonella, inturna* (= *rufa*), *epidero, lenea,* and *drogheda.* Note that the first group includes the genotypes both of *Callithomia* (*alexirrhoë* Bates) and of *Corbulis* (*agrippina* Hewitson = *Epithomia callipero* Bates). A reëxamination of the characters such as the discocellular veins of the hindwings, the humeral, and the hair patch, by which I separated the two names previously (1940, Trans. Amer. Ent. Soc., vol. 66, pp. 194–195), demonstrates that there is complete intergradation. *Corbulis* Boisduval (1870) and *Epithomia* Godman and Salvin (1879) both fall before *Callithomia* Bates (1862). The second group, made up of species which must be disassociated from *Dircenna,* seems to be only a slight developmental step beyond *Callithomia.* Genitalically, the length of the subterminal spine of the penis is the only distinguishing feature, and that itself is gradated among the species, strongly suggesting a complete transition to the species of classical association in *Callithomia.* Accordingly I place these forms in *Callithomia.* One might give them a subgeneric name, but they emphatically are not a separate genus. They are very closely connected with *Callithomia* proper, but have only a superficial connection with *Dircenna.*

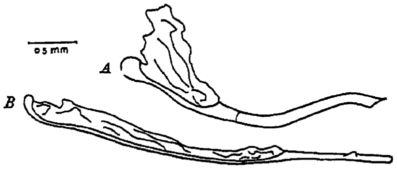


Fig. 4. a, Penis of *Dircenna varina.* b, Penis of *Callithomia beronilla.* (Drawn by R. M. Fox.)

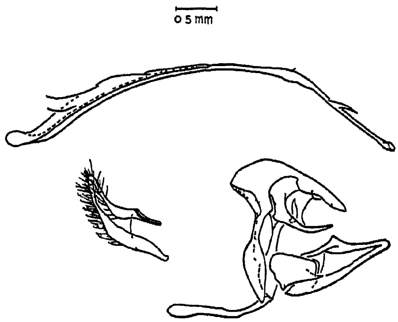


Fig. 5. *Callithomia zingiber,* dissection of male genital armature. (Drawn by Alice Gray.)

Callithomia zingiber, new species

Figures 5, 23, 25

This may turn out to be a subspecies of *C. pulcheria* Hewitson, of which I have seen only the single female in the United States National Museum taken by Coxey at Hacienda La Merced, Tungurahua, Ecuador. Distributional considerations involving *pulcheria, zingiber,* and the species following lead to a separation at this time.

Male and Female: The female of

zingiber is marked exactly as is the female of *pulcheria*, except that the tawny of the forewing is confined to a strip of scaling along the mid part of the anal margin, instead of filling the base of the wing and running out below Cu_1 to the yellow spot. The hindwings are identical on both sides. The under side of the forewing varies between the two forms in the same way as does the upper side, but the submarginal tawny scaling present in *pulcheria* (according to the female seen) is wanting or slight in all six females of *zingiber*. Like *pulcheria* there is a series of yellow transparent spots in the black outer half of the forewing: an oval one Cu_1-Cu_2, a narrow one M_3-Cu_1, a smaller narrow one M_2-M_3, a long streak M_1-M_2, a smaller streak below Rs and an opaque yellow costal spot. These yellow transparent spots are surrounded by black transparent in both *zingiber* and *pulcheria*. The forewing beneath bears three to five white submarginal dots at the apex. The hindwing is orange tawny, slightly more transparent in the disc, with narrow black margins which, when heavier, are scalloped between the veins, and with a black bar over Rs and Sc from the base to the apex of the cell. Beneath, the hindwing bears a series of white submarginal dots placed in the black marginal scallops, and the costal margin itself is tawny orange.

Superficially, the male is completely different, and it was with some surprise that I realized its association with the female. The forewing resembles the markings of *C. epidero* Bates, but the hindwing is unique. Forewing cell with a black triangular spot near the base resting on the cubitus, the margins above R and below Cu-Cu_2 black and opaque, interrupted at the end of the cell by a yellow opaque spot; distal margin narrowly black, wider at the apex; discocellular band black, curving out to fill the basal fourth of M_2-M_3, and not continued strongly over Cu_1, as is the case in *epidero*. The hindwing has a narrow black border scalloped lightly between the veins, preceding which is a brilliantly orange tawny opaque band nearly 4 mm. wide at Cu_1-Cu_2, narrowed to about 1 mm. in M_3-Cu_1 and wider around the apex; disc of the wing transparent, tawny suffusion on the veins and in the cells except near the orange border; between this tawny transparent and the marginal tawny opaque is a band of transparent, situated about where the black loop of *C. lenea* Cramer would be. Beneath, some subapical white dots on the forewing and a complete series on the hindwing. In both sexes the submarginal dot of the hindwing at M_2-M_3 is weak or wanting.

Antennae black with yellow clubs; head and thorax black with a few white spots; abdomen black brown above, yellow green beneath, with some yellow green spots on the sides of the posteriormost segments, and a lateral streak on the anteriormost segment.

TYPE MATERIAL: Holotype, male, Mayaico, Rio Nangarico, Santiago-Zamora, Ecuador, 1000 meters, November 21, 1941 (genitalia slide 425). Allotype, female, Zumbi, Rio Zamora, Santiago-Zamora, Ecuador, 700 meters, November 10, 1941. Paratypes: one female, Mayaico, Rio Nangarico, Santiago-Zamora; four females, Zumbi, Rio Zamora, Santiago-Zamora.

Callithomia lauta, new species

Figure 24

Coxey collected a female on the Rio Pastaza at the same station, Hacienda La Merced, and on the same day that he captured the above-mentioned female of *C. pulcheria* Hewitson. Although it may be only an aberration of *pulcheria*, the considerable difference in the development of the pattern elements leads me to believe that it is distinct. I have been unable to associate it with any described form.

FEMALE: Like *C. zingiber* Fox, the tawny of the forewing is confined to a small area at the middle of the hind margin, the rest of the wing being black with light spots between the veins. But whereas these light spots in *zingiber* and *pulcheria* are surrounded by black transparent, in *lauta* the black transparent is found only in Rs-M_1 and at the end of the cell above Mr, the other spots being sharply defined by the opaque black along the veins and at the distal margin. The black scaling on the veins is narrow, a little wider on Cu_1. The light spots are yellow transparent, their outer parts (except the one just below Rs) being more opaque and scaled with bluish white. The yellow costal spot is much elongated, running from just proximad of the base of R_1 to the base of R_3-R_4. There is a yellow transparent spot in the end of the cell below Mr; base of cell solidly black. The hindwing above is tawny orange with narrow, scalloped black border and semi-transparent disc as in *pulcheria* and *zingiber*. Forewings below with five subapical white spots. Hindwing below as in *pulcheria* and *zingiber* except that the marginal black is triangular between the veins and contains larger white submarginal spots in the apices of the triangles. There is a distinct, though narrow, black loop, as in *C. lenea* Cramer, running down from the outer end of the black costal bar, parallel to the margin, ending just beyond Cu_1, and marking the boundary between the opaque and the semi-transparent tawny orange. Antennae and body as in *zingiber*.

This is one of the most beautifully colorful Ithomiinae I have seen. The bluish white shading on the yellow spots of the forewing is particularly striking, being better described, perhaps, as pale blue.

TYPE MATERIAL: Holotype, female, Hacienda La Merced, Rio Pastaza, below Baños, Tungurahua, Ecuador, 4000 feet, March, 1930 (W. J. Coxey), in the United States National Museum.

Velamysta phengites, new species

Figures 6, 17, 20

This is closest to *V. cruxifera* Hewitson but is definitely a distinct species, and the two were found together by Brown. Aside from a number of genitalic differences, the coloration and pattern differ markedly, although the same pattern elements are present. *V. phengites* is slightly smaller than *cruxifera*, the dark discocellular spot of the forewing is reduced to some scaling on the veins, the transparent smoky areas of both wings are much lighter, the orange on the costal margin of the forewing does not extend beyond the cell apex, the hindwing has an ochre cast rather than whitish and lacks the strong postmedian smoky shade, and the margins of the wings are less indented between the veins. The appearance of this insect is very similar to *Greta ortygia* Weymer and to *Godyris cleonica* Hewitson, both of which Brown found flying with it.

MALE AND FEMALE: The forewing of the male is transparent; costal margin ochre brown, rather lighter and more orange proximal of the cell apex; distal margin of the same color, narrow, dentate on the veins; hind margin similarly colored behind cubitus-Cu_2, some black scaling along the edge of the wing; discocellular veins blackish; all other veins ochre brown except the extreme proximal end of M_1 which is whitish. A very faint whitish cell bar; a narrow white spot indenting the costal margin just beyond the cell apex; below the radius and at the end of the cell it is continued as a transparent white spot which crosses the base of M_1. Transparent white spots as follows: a larger one on the base of Cu_1-Cu_2; a small oval one M_2-M_3 one third of the way out to the margin from the cell; five against the marginal color between veins R to Cu_2, and two between M_1 and M_3 the smallest. Hindwing transparent, clouded with ochre, especially toward the anal angle; hair pencils gray brown, the little outer one over a round white spot; the friction patch pearly brown; distal margin not sharply defined, narrow, ochre brown, partly replaced proximad with ochre orange from M_3 to the anal angle; transparent white spots against the marginal color from R to M_3, and a suggestion of another spot below M_3; a very faintly whitish spot over the base of

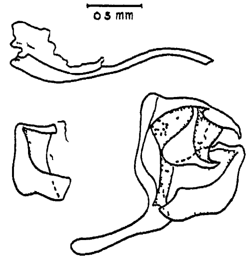


Fig. 6. *Velamysta phengites*, dissection of male genital armature. (Drawn by R. M. Fox.)

M_1; Cu_2 and the anal veins ochre orange; all others ochre brown. The forewing beneath exactly as above, the marginal color a little lighter; pearly brown friction patch at the anal margin. Hindwing beneath as above; radius black brown from the base to the cell apex; costal margin and humeral angle gray ochre anterior of Sc; an oval gray white spot over the thickening of R, but the vein itself ochre brown here; marginal color lighter than above. Genitalia mostly similar to *cruxifera*, but vary from it in the shape of the valve, which in *cruxifera* is pointed but in *phengites* rounded.

The female is like the male, but the coloring is stronger, the borders are slightly wider; the white spot on the costal margin of the hindwing is, of course, wanting. R and M_1 stalked, Sc coalesced with the radius to within 3 mm. of the cell apex, its free length no longer than 3d.

Antennae in both sexes black; head, thorax, and legs black, white scaling; abdomen black brown above, ashen beneath.

Type Material: Holotype, male, San Pablo, near Baños, Tungurahua, Ecuador, 2200 meters, October 15, 1938. Allotype, female, same data. Paratypes: one male, topotypic; two males and one female, Rio Blanco, near Baños, Tungurahua (genitalia slide 382); one male, Yungilla, near Baños, Tungurahua.

Pteronymia browni, new species

Figures 7, 16

Male: This is of the same size, wing shape, and scheme of markings as *P. ticida* Hewitson, but the clubs of the antennae are yellow, not black. All black markings are heavier, especially the forewing discocellular band, and there is a clear yellow tinge on the disc of the hindwing, very slight at the extreme base of the forewing. *P. ticida*, by contrast, has an orange yellow tinge on the bases of both wings. Beneath, the margins of *P. browni* are solidly black, without any trace of tawny scaling, and the white dots at the apex of the forewing and in the hindwing border are small, round. In *ticida* these spots are oblong or elongated, not round, and the black border has a little tawny brown scaling at the veins of the hindwing.

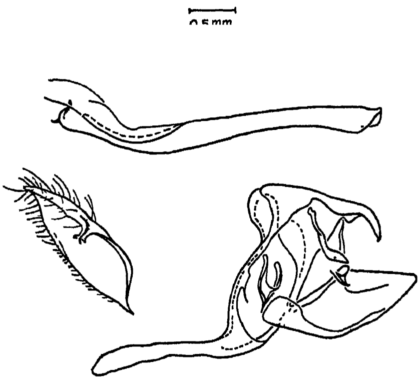


Fig. 7. *Pteronymia browni*, dissection of male genital armature. (Drawn by R. M. Fox.)

This species is named for Mr. Frank Martin Brown.

Type Material: Holotype, male, Rio Jondachi, near Archidona, Napo-Pastaza, Ecuador, 800 meters, November, 1939 (genitalia slide 434).

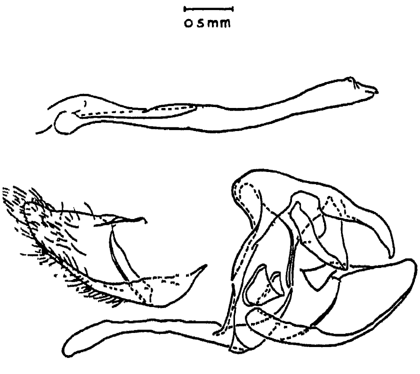


Fig. 8. *Pteronymia gertschi*, dissection of male genital armature. (Drawn by Alice Gray.)

Pteronymia gertschi, new species

Figures 8, 19

This species is similar to *P. tucuna* Bates, of which fine series were taken in northern Peru both by Bassler and by Klug. *P. gertschi*, however, is a little smaller, and the pattern is essentially different, although this is not immediately obvious because the elements are obscured by partial transparency. The dark discocellular band of the present species is narrower, ends in an acute point at the lower end of 3d, whereas in *tucuna* the band is broader, covers the cubital segment and enters the base of M_2-M_3. Further, there are no yellow transparent spots on the forewing apex of *gertschi*, the yellow median cloud of the forewing does not approach so closely to the borders, and its distal side is a straight line. Beneath, the brown of the borders is a little darker, more reddish, and the hindwing submarginal spots are flatter, nearer the margin with less white showing. Bassler found what I have taken to be typical *tucuna* flying along the lower Santiago; *gertschi* was collected upstream a relatively few miles. It is possible that their distributions overlap.

MALE AND FEMALE: Forewing of the male transparent; costal margin in the radius and distal margin narrowly, apex a little wider, hind margin behind cubitus-Cu_2 all black; discocellular band black, narrow, wedge shaped, ending acutely at the lower end of 3d. A sulphur yellow spot indenting the costal margin just beyond the discocellular band, continued as a transparent oblong spot which stands away from the dark band, with transparent between them, and ends at, but does not include, M_2. A long transparent yellow dash M_2-M_3, placed distal of the oblong spot above it, separated from it by the black vein and serving as a continuation of it; even with the distal tip of this dash is a small short dash next to the dark border in M_3-Cu_1; an oblong dash filling the center of Cu_1-Cu_2; some yellow transparent in the outer third of the cell. All veins black except under the yellow discal spot. Hindwing with gray black pencil over a pearly black friction area; the distal margin black, fairly uniform in width, although a little widened near the cubitals, and tapering to a fine line beyond the anals. Rest of wing transparent, a yellowish cloud includes the cell, the proximal two-thirds of M_1-M_2, the basal fifth of M_2-M_3, half of M_3-Cu_1, two-thirds of Cu_1-Cu_2, and most of the anal cells. The distal edge of this cloud is a fairly straight line; between the yellow and the border, the wing is colorless, transparent, the veins here being black, while in the cloud they are yellow. Beneath, the forewing with discocellular band and costal marginal color as far as the cell apex very dark red brown; costal margin beyond cell, and apical and distal margins ochre brown; hind margin a pearly black friction area; margins finely lined black distad; three small white apical spots, ringed black, mostly triangular. Hindwing beneath with central transparent area exactly as above; borders ochre brown, lined with black on each side, the marginal line a little broader, containing a series of flattened lunate black spots with smaller streak-like white centers; a black streak between the radius and Sc; costal margin and humeral angle ochre brown.

The female is substantially like the male. Borders and bands slightly heavier, yellow cloud somewhat stronger.

Antennae black with yellow brown clubs; head, thorax, and legs black with white scaling and spots; abdomen black brown above, sulphur yellow beneath.

This species is named for Dr. Willis J. Gertsch of the American Museum of Natural History.

TYPE MATERIAL: Holotype, male, Sucua, Santiago-Zamora, Ecuador, 900 meters, February 1, 1939 (genitalia slide 433). Allotype, female, between Rio Tutenongoza and Sucua, Rio Upano, Santiago-Zamora, Ecuador, 900 meters, February 10, 1939. Paratypes: one male, between Rio Tutenongoza and Chupientsa, Rio Upano, Santiago-Zamora; one male, between Chupientsa and Rio Tayusa, Rio Upano, Santiago-Zamora.

Episcada comstocki, new species

Figure 15

Twelve females collected by Brown and two by Coxey seem to be an undescribed species. I have not seen any males which seem to belong with the series. As far as the description by Haensch *in* Seitz goes (1909, *op. cit.*, vol. 5, p. 151), they fit *E. cabenis* Haensch, but do not match Haensch's figure and his original description (1905, Berliner Ent. Zeitschr., vol. 50, p. 171, pl. 5, fig. 6).

FEMALE. The wings are transparent,

evenly and very lightly dusted with white, with narrow black brown margins, a pointed discocellular band on the forewing, an orange brown streak between Rs and Sc above the forewing cell. Beneath, the margins are ochre, narrowly lined with brown on each side, and extremely minute whitish dots in the outer edge of the border at the apices of both wings. The humeral angle and costal margin above Sc of the hindwing are clear yellow. The forewing has an opaque white band against the dark discocellular band, beginning with the oblong costal spot and continuing of an even width to M_3, where it is cut off sharply. The veins are white within this band. There is a faint white spot in the anal angle of the forewing. Antennae black; head, thorax, and upper side of abdomen black brown; abdomen beneath clear yellow.

This species is named for Mr. William P. Comstock of the American Museum of Natural History.

TYPE MATERIAL: Holotype, female, Hacienda San Francisco, Rio Mapoto and Rio Pastaza, Tungurahua, Ecuador, 1300 meters, September 27, 1938. Paratypes: nine females, topotypic; two females, Rio Margarjitas, Rio Pastaza, Tungurahua; two females, Hacienda Mascota, Rio Topo, Napo-Pastaza (Coxey).

Campos' record (1927, *ibid.*, nos. 27–28, p. 10) of *Ithomia salvinia* Bates may possibly be this species.

Hypoleria santiagona, new species

Figure 18

The hindwing venation is characteristic of a few *Hypoleria* species, especially *H. orolina* Hewitson, in which Rs, M_1, and 3d are complete, not atrophied, and the cell is closed. Slightly smaller than *orolina,* and with the same general scheme of color and pattern, which is found also in *H. sedusa* Haensch and *H. oculata* Haensch.

MALE: *Hypoleria santiagona* differs from similar *Hypoleria* species in that the yellow tawny band of the hindwing is densely scaled throughout and is sharply delineated proximad by a narrow opaque brown line. All veins in the hyaline areas of the wing are brown scaled. The discocellular band is wider than in *orolina,* bifid at the lower corner of the cell, continued over M_2 and M_3 as far as the brown line preceding the tawny band. A transparent costal spot lies beyond the cell apex, slightly whitened; the base of M_1 is slightly white, crossed by a vague whitish spot. There is a whitish suffusion in Cu_1-Cu_2 and in the end of the cell. The tawny band fills the subapical area and is more narrowly continued in the cubital-distal margin to the anal angle. Hindwing above with thinly brown veins, black brown margins with rusty brown central line (as in *orolina*), the rest of the wing hyaline. Beneath as above, the white admarginal spots of the forewing forming a nearly continuous line in the apex; a row of narrow, long admarginal white spots in the hindwing. Antennae black; abdomen brown above, white below.

TYPE MATERIAL: Holotype, male, between Chupientsa and Rio Tayusa, Rio Upano, Santiago-Zamora, Ecuador, 750 meters, February 11, 1939. Paratype: one male, Rio Santiago, Peru [Ecuador] (Bassler).

VELADYRIS, NEW GENUS

Figures 9, 10

This genus is erected to receive *Ithomia pardalis* Salvin and its Peruvian subspecies, *Velamysta totumbra* Kaye, which have been placed with *Velamysta.* The venation of the hindwing separates these forms at once from *Velamysta,* while the male genitalia indicate a relationship with *Godyris* rather than with the *Dircenna* complex to which *Velamysta* belongs.

Male with two well-separated hair pencils on the hindwing, a small basal one and a larger darker outer one placed about halfway out to the end of the cell, both patches lying posterior to R. Humeral of both sexes bifid; forewing with 2d angled (3d in *Velamysta*). In the male Sc and R separate at the base, running closely parallel for a few millimeters, then Sc swings away and then back, outlining a raised area (as in *Hypoleria*), inosculating, in the specimens examined, with Rs near the margin. Veins not swollen at cell apex; Rs swings upward at the upper end of 1d; 1d, R, and Rs together form a narrow "Y"; 2d angled.

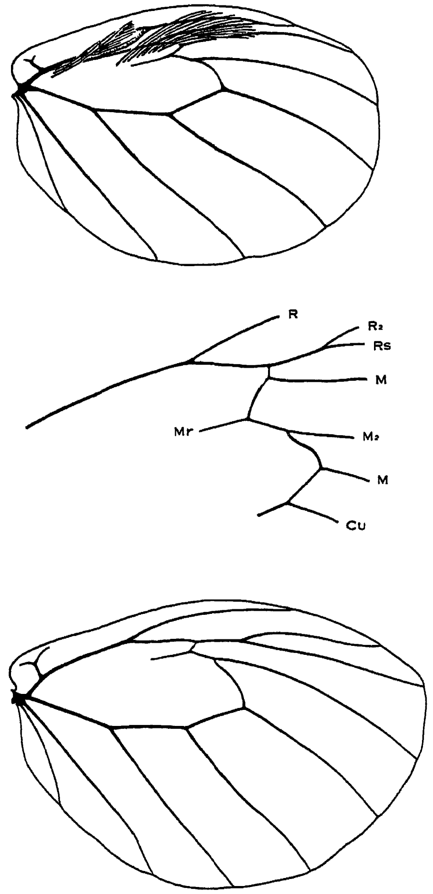


Fig. 9. *Veladyris pardalis*, male hindwing, detail of female forewing, female hindwing. (Drawn by Alice Gray.)

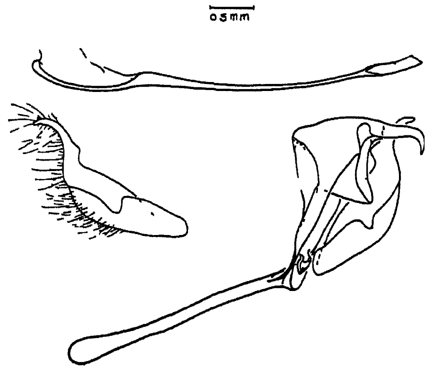


Fig. 10. *Veladyris pardalis*, dissection of male genital armature. (Drawn by Alice Gray.)

emitting a long Mr, the upper arm equal in length to 1d, the lower arm half the length; 3d complete, curved, about twice the length of 1d; anterior side of cell much shorter than posterior side; Rs and M_1 not inosculating. Female with Sc and R completely united as far as halfway to the cell apex, then Sc swings steeply away, curving to reach the margin in the wing apex, its total length more than twice the greatest width of the cell; 1d wanting, M_1 and Rs separating well beyond the cell apex; 2d, 3d, and Mr as in the male.

Male genitalia closest to *Godyris*, but the valves narrower and the penis far more slender; gnathos stronger than in *Hypoleria*, uncus heavier and penis much longer in proportion.

GENOTYPE: *Ithomia pardalis* Salvin.

DYGORIS, NEW GENUS

Figures 11, 12

Ithomia dircenna C. and R. Felder has been placed in *Godyris*, but an examination of a pair of this rare species (San Martin district, Peru, collected by Woytkowski, in the Carnegie Museum) shows that it must be placed in a separate genus. The male genitalia and the female hindwing venation distinguish this from any other genus.

The hindwing of the male is hardly separable from that of *Godyris*. The hair pencil is long, single; humeral vein lightly bifid; 1d very short, 2d five times as long, 3d atrophied, cell open; Sc atrophied before emarginating. The female hindwing has 1d and M_1 totally wanting, 3d angled with the lower arm straight, not curved.

In the male genitalia, the tegumen is narrow, not broadened as in most Ithomiinae. Uncus relatively short (about one-quarter the height of the genitalia) and broad, not produced to a point, semi-oval on the whole, membranous, heavily spined, its posterior edge cleft (my slide gives the appearance of a manatee's nose!). Valves small, narrow, apex produced into a blunt curved point, costal margin negligible, ventral fold produced to a sharp tooth at its anterior end, heavily spined. Penis strongly curved, S-shaped; proximal end broad, foramen one-third its length.

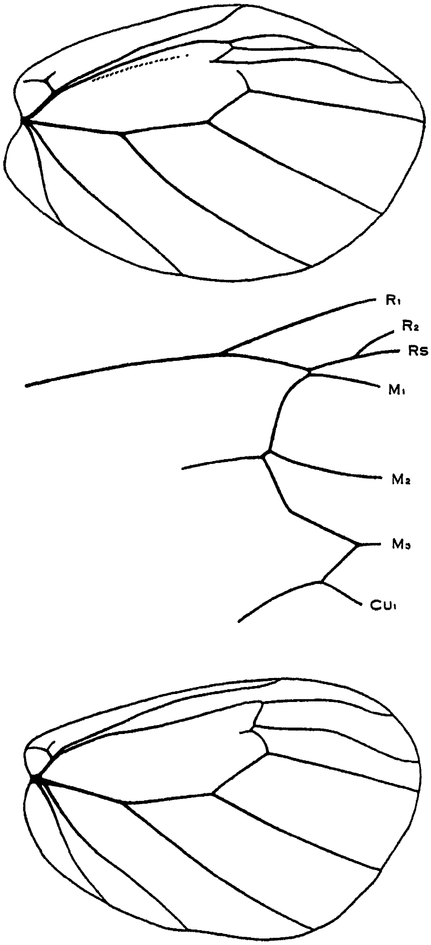


Fig. 11. *Dygoris dircenna*, male hindwing; detail of female forewing, female hindwing (Drawn by R. M. Fox.)

GENOTYPE: *Ithomia dircenna* C. and R. Felder.

Dygoris dircenna pastazana, new subspecies

Figures 12, 22

MALE AND FEMALE: The wing pattern is just as in *dircenna dircenna* C. and R. Felder, but the cell bar and the bar over the cubital segment of the forewing and the bar across M_3-Cu_1 of the hindwing are heavier in the male, the dark patch at the end of the hindwing cell is entirely wanting in the female; the admarginal spots beneath are narrower; the dark color on the upper is much lighter than in *dircenna*, being a rusty brown rather than black brown; the yellow patches in the transparent postdiscal forewing area of the male are fainter and more diffuse; 3d and 4d are entirely yellow.

TYPE MATERIAL: Holotype, male, El Partidero, Rio Anzu, Napo-Pastaza, Ecuador, 1000 meters, September, 1935 (genitalia slide 420). Allotype, female, Pacaiyacu, Rio Bobonaza, Napo-Pastaza, Ecuador, 800 meters, September, 1938.

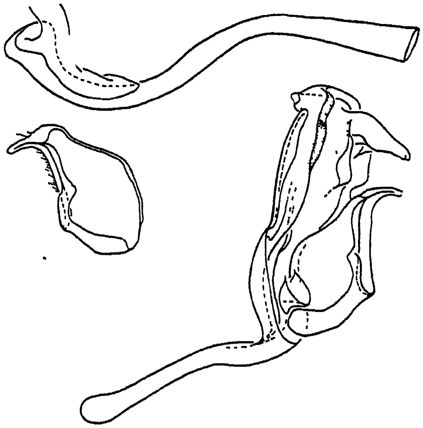


Fig. 12. *Dygoris dircenna pastazana*, dissection of male genital armature. (Drawn by Alice Gray.)

HYPOMENITIS, NEW GENUS

Figures 13, 14

Hypomenitis, which so far as I know is monotypic, is distinguished from *Godyris* by the genitalia, by the two separated hair pencils and the nonbifid humeral vein. It differs from *Greta* by the hair patch, which in that genus is either single (continuous) or, if divided, the two parts are not well separated. In *Greta* females 2d is wanting, with M_1 and M_2 stalked. In *Hypomenitis* 2d is present, M_1 and M_2 distinct. It is distinguished from *Hypoleria* by the humeral vein in both sexes and by the strong 1d of the females which is wanting in *Hypoleria*.

Humeral vein of the hindwing simple, not bifid. In the male there are two well-

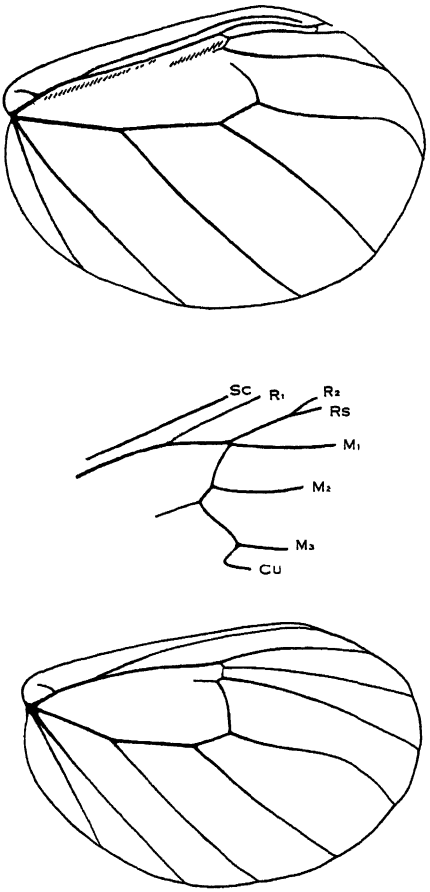


Fig. 13. *Hypomenitis theudelinda*, male hindwing, detail of female forewing, female hindwing. (Drawn by R. M. Fox.)

separated hair patches, the basal one of which is long, the distal one consisting of only a few hairs in the cell apex. Sc separating from R gradually, atrophied opposite the cell apex; 1d and 2d both short, about equal in length, 1d forming an obtuse inside angle with Rs, and about a right angle with 2d; 3d evenly curved, longer than 1d plus 2d by far, atrophied at its anterior end, the cell open. All other veins complete and reaching the margin. In the female, Sc gradually separates from R, reaching the margin above the cell apex; 1d two-thirds the length of 2d, 3d long, the main part evenly curved, the short Mr emitted from an angle of 3d which is situated close to 2d.

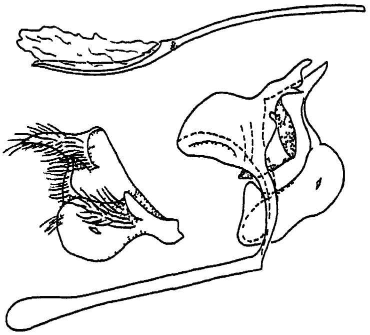
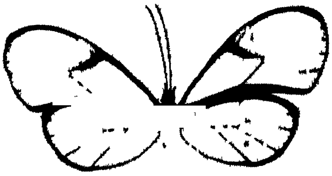


Fig. 14. *Hypomenitis theudelinda*, dissection of male genital armature. (Drawn by R. M. Fox.)

Male genitalia characterized by the slender penis, the peculiarly shaped uncus, and the valves, which are constricted below the distal process and bear a wide in-turned fold which is continuous with the juxta.

Genotype: *Ithomia theudelinda* Hewitson.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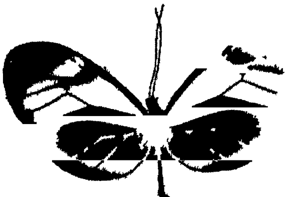
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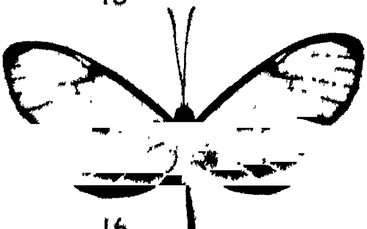
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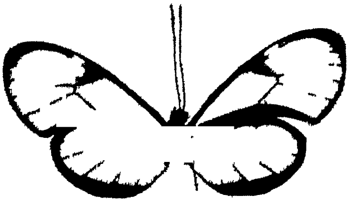
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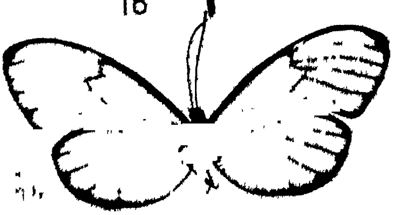
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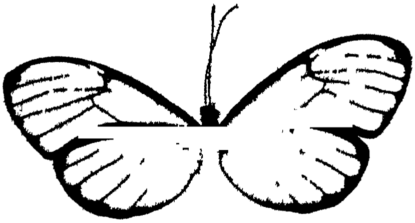
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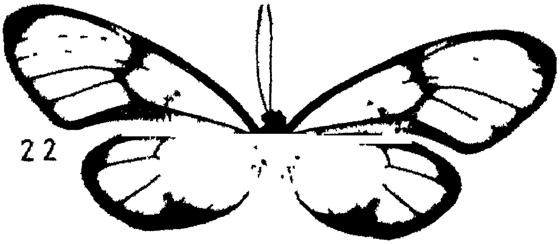
Fig. 15. *Episcada comstocki*, paratype, female.
Fig. 16. *Pteronymia browni*, holotype, male.
Fig. 17. *Velamysta phengites*, holotype, male.
Fig. 18. *Hypoleria santiagona*, holotype, male.
Fig. 19. *Pteronymia gertschi*, paratype, male.
Fig. 20. *Velamysta phengites*, allotype, female.
Fig. 21. *Melinaea vespertina*, paratype, female.



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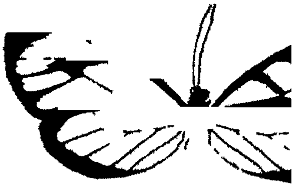

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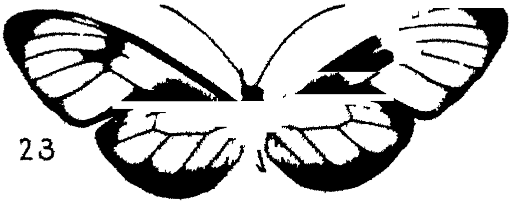

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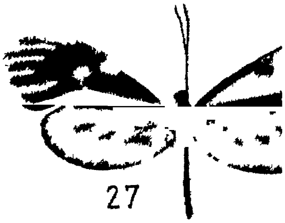

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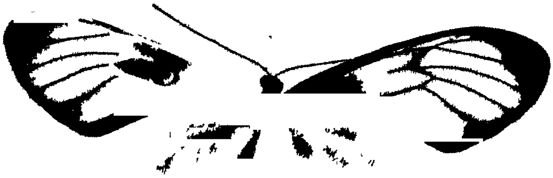

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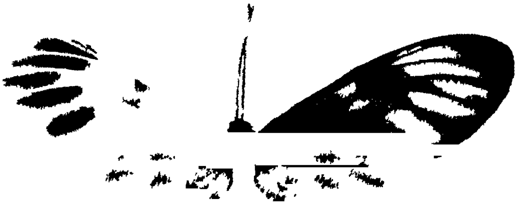

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Fig. 22. *Dygoris dircenna pastazana*, holotype, male.
Fig. 23. *Callithomia zingiber*, holotype, male.
Fig. 24. *Callithomia lauta*, holotype, female.
Fig. 25. *Callithomia zingiber*, paratype, female.
Fig. 26. *Ithomia diasia browni*, paratype, male.
Fig. 27. *Ceratinia bisulca*, paratype, male.
Fig. 28. *Hypothyris meterus zephyrus*, holotype, female.

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A GENITALIC SURVEY OF ARGYNNINAE (LEPIDOPTERA, NYMPHALIDAE)

BY CYRIL FRANKLIN DOS PASSOS AND LIONEL PAUL GREY

While preparing manuscript for a revision of the North American butterflies usually referred to the genus *Argynnis* Fabricius (1807, p. ix), it seemed advisable to publish separately our notes on the genitalia of some of the associated world species. Our intention is to give a skeleton outline of genitalic data for the subfamily, sufficiently complete to demonstrate the peculiarities of the Nearctic species and to serve as a basis for comparisons.

When the present paper was submitted for publication, the monograph by Warren[1] reviewing the classification of Argynnidi, which includes a revision of *Boloria* Moore (1900, p. 243), to which consideration is given in the discussion toward the end of this paper, had not been published. Warren points out, as we do, the excellent usefulness of the male genitalia in giving better classificational results than those hitherto obtained by the use of wing pattern, especially in providing unfailing generic characters. We are keeping to the older classification except in those instances where the need of recognizing outstanding genitalic groups is imperative, and we are proposing no new names since Warren's monograph is complete for those groups which he has studied so painstakingly. Although some duplication is unavoidable because of our intention to give fairly complete subfamily data, our paper is written primarily for American students and is published in the belief that to some little extent it may supplement Warren's revision and perhaps further serve to call attention to the results obtainable by genitalic analysis. Our purpose is to establish the isolated position of the Nearctic species, and to do this it proves necessary to discuss Argynninae of the world, since the popular generic conceptions are inadequate or erroneous.

The systematic arrangement follows obvious genitalic analogies which give basis for a rough preliminary separation of related species, following tangible similarities. The exact sequence is merely tabulative; other data would have to be considered before attempting further refinement to show phylogeny.

The dissections, genitalic slides, and drawings are the work of the junior author, and unless otherwise indicated the specimens and slides are in his possession. The figures should be used with caution, if at all, for specific identifications; the dissections were not done in revisional amplitude and are intended only to establish relationships and subfamily range of variation in the sexual structures.

The terminology used for the various parts of the male genital armature is indicated by figure 54 which shows the complete genitalia of *Speyeria atlantis* (Edwards) (1862a, p. 54) and is further defined below.

DESCRIPTION OF THE MALE GENITAL ARMATURE

Figure 54

The large hood-shaped *tegumen* (ninth segment) is a modified tergite to which the attached *vinculum* is the accompanying sternite of the so-called genitalic ring. The vinculum is usually enlarged ventrally, forming a *saccus*, which is well developed in Argynninae but never greatly extended. Interesting features found in many species of this subfamily are the paired, flattened

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[1] Warren, B. C. S., Review of the classification of the Argynnidi: with a systematic revision of the genus *Boloria*, 1944, Trans. Roy. Ent. Soc. London, vol. 94, pp. 1–101, pls. 1–46, figs. 1 317.

lobes attached within and near the base of the tegumen which are best seen cephalad but may be extruded for lateral study. These do not seem to be identical with any of the named accessory organs. If they are representative of a gnathos they are indeed aberrant. Judging from the articulation they may be homologous with the transtilla of certain other Lepidoptera, but it seems safest to apply a separate designation. We are terming them *vanni* (singular, *vannus;* Latin, a fan). The tegumen is often broken into more or less separately sclerotized areas, of which a small, outermost ventrocaudal segment is usually partly free or joined only by membrane, yet with very remote analogy to a subscaphium or to a peniculus. There is a dorsal area in the tegumen which is membranous. The *anellus* is immediately above and caudad of the saccus. In figure 54 a separate view, cephalad, is given since the anellus lies within the armature at a right angle to the lateral plane. In form, it is a pair of extended lobes, providing support for the *aedeagus.* The latter is conspicuous, often with distinct modifications in shape, sclerotizations, and cornute armature.

The *valves,* paired, flattened organs said to be derived from the pedal appendages of the ninth segment, are articulated dorsally at the juncture of the vinculum and the tegumen and ventrally upon the saccular portion of the vinculum and to the anellus. Since these valves vary greatly in form, there is a special terminology for the parts. Three general areas are recognized. We have used the term *dorsal lobe* for the free basal portion of the costa; this bears the hook-like sclerotization by which dorsal articulation is made to the genitalic ring. The costal area narrows medially to little more than a sclerotized margin where it joins with the *cucullus* or central division of the valve. The "superior process" (or processes) is usually considered to belong with the costa. In Nearctic *Speyeria* Scudder (1872, p. 23) a heavily sclerotized plate replacing the dorsal distal extension has been separately termed a *digitus.* These dorsal specializations are somewhat to the rear of, and often partly concealed by, the variously modified distal portions of the cucullus. In *Boloria* the "inferior process" of the valve, which we call a *cucullus termen* (not realistically portrayed on a plane surface, being three-dimensional like the sharply curved prow of a boat), is formed, as figures 1–21 suggest, by the terminal valve sclerotization. In dissections that have had no pressure this cucullus termen usually lies at almost a right angle to the valve surface, and in making slides to display in so far as possible all of the features that appear to be of special interest, we have arranged the separately dissected valve so that the cucullus termen is uniformly bent dorsad to show its outline. Many species of *Argynnis* have an oblique, spiny ridge or *crista obliqua* extending from the median area of the cucullus and joining to the costa. This "crista obliqua" of Petersen (1904, p. 50, fig. 18) may be homologous with the harpé as the latter term is used by McDunnough (1911, p. 188) judging from Forbes' (1939, pp. 7, 9) analysis of the musculature, or possibly the harpé also includes the distal dorsal process. The heavy sclerotization often found immediately basad or distad of this spiny ridge on the upper border of the cucullus appears to be a clasping specialization. The bell-shaped dark area often noticed near the base of the valve is formed partly by the roll of the *sacculus* (ventral and foremost portion of the valve) at that point but is due in part to interior processes leading to the anellus. The *uncus* is considered as representing the tergite of the tenth segment. The corresponding sternite (subscaphium and/or socius) often is atrophied or absent in Argynninae. The uncus often is specifically varied in shape as well as being of important diagnostic value in grouping related species. It is prominently located, attached to the dorsocaudal portion of the tegumen. Definite characters may occur in any of the parts of the whole armature.

Further remarks concerning the genitalic peculiarities will be found under the appropriate generic and specific headings. Figures 1–48 give selected views of the anellus, aedeagus, valves, and uncus of the species studied.

DESCRIPTION OF THE FEMALE GENITAL ARMATURE

No survey of the female genital armature in Argynninae has been attempted by us. We have investigated that of the Nearctic genus *Speyeria*, finding some helpful differences (figs. 52, 53). It seems likely that the other groups would yield similarly valuable hints as to phylogeny and further aids toward specific determinations; therefore we give an abbreviated description of the morphology.

The external anatomy, including thoracic articulation, spiraculation, and details beyond the seventh (last regular) segment, may be studied prior to dissection. The ovipositor lobes of the tenth segment are well extruded, but the *apophyses* or ovipositor struts are partly concealed by the telescoped collar of the ninth segment and by the eighth segment which forms the so-called genital plate. The *ostium*, notch of the vaginal opening, is at the base of the eighth sternite, and there is a membranous protrusion between the seventh and eighth tergites, which we call the *dorsal gland.* We are uncertain whether this is a scent pouch or the cement-forming *colleterial gland* (Torre-Bueno, 1937, pl. 3, fig. 2). Many of the interior organs having to do with insemination and ovulation are so complex and so delicate that morphological comparisons are very difficult. Dissections should be preceded by a staining process and by a glycerin to water transfer so that these membranous parts may be properly dilated and made easily visible. The well-sclerotized *ductus bursae* leads directly from the ostium to the *bursa copulatrix,* which sometimes has an attached sac or *secondary bursa;* these parts are relatively easy to study. There is no *signum* (sclerotized or corneous area) on the bursa of *Speyeria.*

Argynninae

The genera *Boloria* Moore, *Brenthis* Hübner ([1819], Verzeichniss bekannter Schmettlinge [*sic*], 2d signature, p. 30), *Argynnis* Fabricius, *Speyeria* Scudder, and *Euptoieta* Doubleday (1848, p. 168) are similar genitalically and placed by us in Argynninae. In these genera, within a diversity of genitalic forms, there are basic resemblances which can be appreciated best after comparisons are made with genera which usually are listed near the argynnids. (For example, *Melitaea, Phyciodes,* and *Chlosyne* are entirely different in genitalic structure.) *Euptoieta* is aberrant but is retained here because of customary usage and on account of a slight relationship suggested by wing pattern and genitalic similarity. In some respects *Euptoieta* is intermediate to Heliconiinae (Michener, 1942, figs. 9–17) which is the only group of butterflies in which we have perceived any vague genitalic resemblances to Argynninae. Except for some imperfect linkage to the heliconians, the argynnids are distinct from other nymphalids and would appear to merit recognition as a subfamily. Forbes has suggested (*in litt.*) that we investigate *Basilarchia* and certain African genera to see what relationship they might have to Argynninae, a project which we have been unable to add to the work already undertaken. It is interesting to note that Grote (1900, p. 7) defined by wing venations approximately the major groupings which are indicated by the genital armature, further substantiating the naturalness of the associations.

BOLORIA MOORE

Boloria MOORE, 1900, p. 243. GENOTYPE: *Papilio pales* [Denis and Schiffermüller], 1775, p. 177. FIXATION: Original designation monotypic.

Clossiana REUSS, "1921" [1922], p. 225. GENOTYPE: *Papilio selene* [Denis and Schiffermüller], 1775, p. 321. FIXATION: By original designation.

Under this genus we place the Holarctic species that commonly have been known as *Brenthis*, making no attempt to give more than a brief summary of outstanding peculiarities noted in the male genital armature. As listed here, no subdivisions are made and no emphasis is placed upon definition of species and subspecies or upon order of arrangement. The outstanding distinctions whereby these species are unfailingly separable from the so-called argynnids are of interest because of confusing statements in the literature. Although some refinements in classification could be made, the series of insects listed below are roughly homogeneous in having the valves relatively simple as to the amount of sclerotized development, an aedeagus which is basally closed and an uncus which is bifid (fig. 51), characters which distinguish *Boloria* from other major groups in the subfamily.

Boloria thore (Hübner)

Figure 1

HÜBNER, [July, 1803–1804], Sammlung europäischer Schmetterlinge, [vol. 1], pl. 111, figs. 571–573.

SPECIMEN FIGURED: Europe, *ex* J. Doll collection, *ex* the Museum of Comparative Zoölogy, genitalic slide no. 309.

Boloria may be divided into two groups, depending upon the shape, size, and amount of sclerotization of the dorsal-distal lobular portion of the aedeagus. The *thore* group (figs. 1–15) comprises the majority of the species. In *thore*, the lobes on the aedeagus are small, and the organ also is comparatively small. The dorsal arm and the cucullus termen both are smooth or only very slightly spinose.

Boloria improba (Butler)

Figure 2

BUTLER, 1877, p. 206.

SPECIMEN FIGURED: Torne Trask, Lapland, 3500 feet, July 9, 1937 (Higgins), genitalic slide no. 305, in the American Museum of Natural History.

It is likely that *improba* deserves specific rank. The few dissections which we have made are hardly decisive but point to the conclusion that *improba* is wrongly placed with *frigga* by McDunnough (1938, p. 16) and indicate a separation from *thore*.

Boloria frigga (Thunberg)

Figure 3

THUNBERG, 1791, p. 33.

SPECIMEN FIGURED: Riding Mountains, Manitoba (J. May), genitalic slide no. 346.

The dorsal arm and the cucullus termen are very much more spinose than in *improba* and *thore*. It is believed that *frigga* has a very wide range and subspeciation, expressed in North America by *saga* (Staudinger) (1861, p. 350), *kriemhild* (Strecker) ([1879], p. 1854, pl. 1, figs. 5, 6) *sagata* (Barnes and Benjamin) (1923, p. 146), *epithore* (Edwards) (1864, p. 504), *gibsoni* (Barnes and Benjamin) (1926, p. 92), and other varying populations. Specific separations, if any can be made, become a task for revisional study.

Boloria toddi (Holland)

Figure 4

HOLLAND, 1928, p. 45.

SPECIMEN FIGURED: Salem, Virginia, July 14, 1940 (C. Gottschalk), genitalic slide no. 345.

Since *bellona* (Fabricius) (1775, p. 517, no. 317) is unavailable as a homonym, Holland's name for a northern Quebec population has priority over *ammiralis* (Hemming) (1933b, p. 276), which was proposed to replace *bellona*, a southern subspecies. Genitalically, while still in a group of very similar species, this insect appears to be separable as one of the very few entities confined to the Nearctic fauna. The association with *frigga* is evidenced by the spiny cucullus termen, although the dorsal arm is only very slightly spined. The sclerotized developments in the distal portions of the aedeagus are somewhat atrophied. Purely as a speculation, one might wonder if *toddi* is not a comparatively ancient species. These sclerotizations are almost undoubtedly the homologue and probably the forerunner of the extensively cornute and specialized development of the aedeagus found in the argynnids.

Boloria selene ([Denis and Schiffermüller])

Figures 5, 51

[DENIS AND SCHIFFERMÜLLER], 1775, p. 321.

SPECIMEN FIGURED: Hamburg, Germany, May 30, genitalic slide no. 354.

The Nearctic *myrina* (Cramer) ([1777], vol. 2, p. 141, pl. 189, figs. B, C) and its associated variation are genitalically, as well as in appearance, like *selene* and no doubt belong with it. The interior sclerotized development basad of the membranous distal lobes of the aedeagus is small; from it there are fairly well-defined light sclerotizations along the lobes. The dorsal arm bears several small terminal spiculations. The cucullus termen is not spinose and appears to be constantly recognizable in outline.

Boloria polaris (Boisduval)

Figure 6

Boisduval, "1829" [1828], p. 15.
Specimen Figured: Rama, Labrador, 1894 (A. Stecker), genitalic slide no. 264, in the Museum of Comparative Zoölogy.

The internal sclerotization basad of the aedeagal lobes is spiny-serrate with lightly sclerotized processes upon the lobes. These variations, within loosely arranged and rather amorphous membranous or very delicately sclerotized tissues, are not easy to describe or to draw accurately. Within certain limits the repetitive similarities observed in the dissections of related species suggest that despite individual differences, ease of distortion, and difficulty of exact comparisons, the aedeagus has characters of value. Certainly in *polaris* it is indicative.

Boloria jerdoni (Lang)

Figure 7

Lang, 1868, p. 34.
Specimen Figured: (No data), *ex* Weeks collection, no. 178, genitalic slide no. 316, in the Museum of Comparative Zoölogy.

This Asiatic species displays a valve modification in a process extending from the dorsal basal lobe, although the other differences from the norm of the present group are not striking. The dorsal arm is short and bears long, delicate, hair-like spines in addition to the usual setae. The cucullus termen is smooth.

Boloria gong (Oberthür)

Figure 8

Oberthür, 1884, p. 15, pl. 2, fig. 9.
Specimen Figured: Loutsechiang, Yunnan Province, China (A. Genestier), genitalic slide no. 295, in the American Museum of Natural History.

Only passing mention need be accorded to this rare Himalayan species, differing in slight detail as shown by the figures but apparently not greatly modified in structure from preceding entities. It is to be noted that the sclerotizations in the distal trough of the aedeagus are rather large, with extended sclerotic processes which are comparatively more spiny-serrate than in related species. The dorsal arm is short, distally swollen with a spiny tip. The cucullus termen is smooth, with an outline which seems to be characteristically distinct.

Boloria haberhaueri (Hemming)

Figure 9

Hemming, 1933b, p. 275 (= *Argynnis hegemone* Staudinger, 1881, p. 292).
Specimen Figured: Naryn, [Siberia], *ex* Weeks collection, no. 2854, genitalic slide no. 319, in the Museum of Comparative Zoölogy.

The superficial wing pattern suggests a relationship to *aphirape* (Hübner) ([December 24, 1799–April 13, 1800, vol. 1], pl. 5, figs. 23–25) but, as will be seen by comparison of the juxtaposed figures, the two species are very distinct. In *haberhaueri* the dorsal arm is short with long conspicuous spines; the cucullus termen is smooth, long, and slender, and the aedeagus is of the type usual in this group.

Boloria aphirape (Hübner)

Figure 10

Hübner, [December 24, 1799–April 13, 1800], Sammlung europäischer Schmetterlinge, [vol. 1], pl. 5, figs. 23–25.
Specimen Figured: Riding Mountains, Manitoba, July 12, 1938 (J. May), genitalic slide no. 254.

We believe that *aphirape* should be easy to identify in all of the numerous Holarctic populations by reason of the wide, bilobed dorsal arm. Also, the lack of the usual long sweeping cucullus termen is a peculiarity shared only by *pales* among the species here placed in *Boloria*. In other respects *aphirape* is genitalically like associated species with only minor differences.

Boloria alberta (Edwards)

Figure 11

Edwards, 1890, p. 113.
Specimen Figured: Banff, Alberta, July 13, 1930 (J. May), genitalic slide no. 304, in the American Museum of Natural History.

The dorsal arm is well spined along the upper terminal margin, and the cucullus termen ends in two points. The long, dorsally upcurving tip of the aedeagal tube also appears to be specifically diagnostic. This insect is of limited habitat. Any suspected forms which would extend the known range of this species should be easy to identify with *alberta* by reason of its genitalic peculiarities. Possibly *distincta* (Gibson) (1920, p. 25i) belongs here, but we have no specimen for dissection.

Boloria astarte (Doubleday)

Figure 12

Doubleday, 1847, pl. 23, fig. 5.

Specimen Figured: (*Amphilochus*), Transbaikal, Siberia, *ex* Weeks collection, genitalic slide no. 311, in the Museum of Comparative Zoölogy.

The North American *astarte* is so like the Siberian *amphilochus* (M. [*sic*] Ménétriés) (1858, p. 213) that we had justifiable suspicions of finding, as we do, that they are genitalically identical. The cucullus termen bears several large spines, and the dorsal arm is distally enlarged to an angular lobe. Another distinguishing feature is found in the area of setae which is located dorsad and caudad upon the tegumen. The latter development apparently is unique in the subfamily, other species having at most a very few delicate setae, seen only under high magnification.

Boloria pales ([Denis and Schiffermüller])

Figure 13

[Denis and Schiffermüller], 1775, p. 177.

Specimen Figured: Zermatt, Valais, Switzerland, July 19, 1934, genitalic slide no. 327.

This genotypical species is instantly separable by the somewhat aberrant male genital armature. The heavy spiculations upon the aedeagus differ only in degree from the condition observable in related species. By evidence of the valves, *pales* and *aphirape* are closely related, being the only species of *boloria* known to us that lack the extended cucullus processes. The dorsal arms are likewise analogous. Both *pales* and *aphirape* have the bifid uncus of *Boloria*, but in *aphirape* it is very slender, while in *pales* it is unusually stout.

Boloria dia (Linnaeus)

Figure 14

Linnaeus, 1767, p. 785, no. 207.

Specimen Figured: France, *ex* Eddy collection, genitalic slide no. 236, in the Museum of Comparative Zoölogy.

In *dia* we note that the lobes of the anellus arise from a somewhat modified basal plate. However, although the figures show rather pronounced differences in the shape of the anellus for various species, this is partly due to the condition of individual specimens. The differences are specific to some extent, but the anellus is very easily distorted as it is attached to the valves and varies in outline when they are manipulated. The aedeagus of *dia* is quite sufficient to provide reliable diagnosis.

Boloria freija (Thunberg)

Figure 15

Thunberg, 1791, p. 34, pl. 2, fig. 14.

Specimen Figured: Nordegg, Alberta, May 2, 1933, genitalic slide no. 265.

This insect has an extensive Holarctic subspeciation. Genitalically it is unique, although the characteristically sagittate outline of the aedeagus is due not so much to a basic difference as to an adaptation of form of the terminal lobes. The dorsal arm and cucullus termen are also distinct in outline. The figure obviates further comment. There is no reason to confuse any of the subspecies of *freija* with those of any other species.

Boloria selenis (Eversmann)

Figure 16

Eversmann, 1837, p. 10.

Specimen Figured: Kirin Province, Manchuria, June 3, genitalic slide no. 257.

The remaining species here included in *Boloria* (figs. 16–21) agree with *selenis* in peculiarities of the aedeagus. The distal lobes are extensively sclerotized, there is an increase in the size of these lobes, and the whole aedeagus becomes of formidable proportions in comparison to the remainder of the genital armature. Also, the process arising from the aedeagal trough becomes more sclerotized and notably spinose. The purely specific features will need close attention in work of a revisional nature, but a very helpful preliminary division of species is achieved by noticing that the type of aedeagus described above is readily distinct from that of preceding entities and is peculiar to those that follow. It is interesting to find fully developed structural divergencies in species so superficially alike as are *selene* (fig. 5) and *selenis*, for example. The inference is that by means of genitalic comparisons aberrant specimens, strange appearing new subspecies, and undetermined specimens of *Boloria* can be related to the proper species or at least to a species group with less danger of error than is possible by reliance upon pattern of the wings.

In the specimens of *selenis* that were examined the dorsal arm is slender and spined only very lightly at the tip. The cucullus termen has several distinct spines and a thorn-like termination. The aedeagal lobes are heavily sclerotized on the edges but are relatively membranous centrad and basad. The spinose process basad of the lobes is short and rounded. A close study of related species, which have somewhat similar characters, would be required before it would be possible to say that certain features were invariable in *selenis*.

Boloria euphrosyne (Linnaeus)

Figure 17

LINNAEUS, 1758, p. 481, no. 142.

SPECIMEN FIGURED: Hamburg, Germany, July 21, genitalic slide no. 355.

The dissections of *euphrosyne* reveal a dorsal arm which is somewhat swollen distally with only a very few small spines along the terminal outline. The cucullus termen is spinosely serrate. It is rather short, compressed, nearly square in outline, except for the short terminal spine, and apparently is constant in these respects. The aedeagus is similar to the type described under *selenis*.

Boloria chariclea (Schneider)

Figure 18

SCHNEIDER, 1794, p. 588.

SPECIMEN FIGURED: McKinley Park, Alaska, July 29, 1930 (Fraser), genitalic slide no. 308, in the American Museum of Natural History.

One of the tasks in a revision of *Boloria* will be to unsnarl the subspeciation and the synonymy under *chariclea* and *rossicus* (Hemming) (1933b, p. 276). If *chariclea* is valid as a species, both it and *rossicus* are circumpolar in distribution with subspecies which we must recognize and define, yet both species are genitalically very similar. The insect considered here is not the "*chariclea*" of North American literature and of nearly all American collections but is a northern butterfly with which the majority of students are unfamiliar. Under the name we associate *arctica* (Zetterstedt) (1840, p. 899), *obscurata* (M'Lachlan) (1878, p. 110), and *butleri* (Edwards) (1883, p. 32).

Boloria rossicus (Hemming)

Figure 19

HEMMING, 1933b, p. 276 (= *Papilio amathusia* Esper, [1784], p. 170, pl. 88, figs. 1, 2).

SPECIMEN FIGURED: Mantreux, Germany, June 24, genitalic slide no. 356.

Following the suggestions of Dr. A. B. Klots, we find that several well-known Nearctic insects are very similar to *rossicus*. The populations that have been named *montinus* (Scudder) (1863, p. 166), *boisduvalii* (Duponchel) (1832, p. 127, pl. 20, fig. 4), *grandis* (Barnes and McDunnough) (1916, p. 223), *helena* (Edwards) (1871, p. 268), *ingens* (Barnes and McDunnough) (1918, p. 71, pl. 11, figs. 5, 6), and *rainieri* (Barnes and McDunnough) (1913, p. 96, pl. 2, figs. 1–4) are genitalically and superficially like this European insect. The variation in the male armature among these North American representatives may be greater, judging from the few dissections, than the differences observed between *rossicus* and *chariclea*. We are not in a position to make definite comment other than to note the close genitalic relationships. The cucullus termen is more sclerotized and less elongate, therefore more difficult to bend to secure a plane outline in a slide than is the case with most of the other species in *Boloria*, and the bending results in some distortion. The lobes of the anellus are large in size and possibly are diagnostic of the species in their shape.

Boloria oscarus (Eversmann)

Figure 20

EVERSMANN, 1844, p. 588, pl. 14, figs. 1a, 1b.

SPECIMEN FIGURED: "Tunkinsk, Weisgbg., sudwesti Irkutsk," [Siberia], 2060 m[eters], July, *ex* Weeks collection, no. 421, genitalic slide no. 318, in the Museum of Comparative Zoölogy.

This Siberian butterfly belongs genitalically with the *selenis* group but is specifically distinct. The cucullus bears a long, large terminal spine with a smaller spine at the outer angle and is smooth except for these processes. On the valve there is a serration which by position is analogous to a rudimentary crista. This is observable under close examination in many of the species of *Boloria*. The saccus is unusually heavy and very noticeable because in the majority of the species of *Boloria* the saccus is only slightly wider than the remainder of the vinculum. The aedeagus is relatively large.

Boloria angarensis (Erschoff)

Figure 21

ERSCHOFF, 1870, p. 112.

SPECIMEN FIGURED: "Transbaikal, mer. occ. Borochojewa, Maichan Montes," [Siberia], 800 m[eters], July, *ex* Weeks collection, no. 556, genitalic slide no. 317, in the Museum of Comparative Zoölogy.

A unique, large, heavily serrate cucullus termen insures the genitalic recognition of *angarensis*. The saccus is well developed as in *oscarus*. The uncus of *angarensis* and of the two species immediately preceding have been figured merely to indicate the similarities which prevail in this organ throughout *Boloria*.

BRENTHIS HÜBNER

Brenthis HÜBNER, [1819], Verzeichniss bekannter Schmettlinge [*sic*], 2d signature, p. 30. GENOTYPE: *Papilio hecate* [Denis and Schiffermüller], 1775, p. 179. FIXATION: Scudder, 1872, p. 24.

It is apparent that *Brenthis* with genotype *hecate* cannot apply to the numerous species which have been called brenthids in the past. The *hecate* group consists of the three species listed below. They are confined to the Old World and are structurally distinct from the large Holarctic group heretofore listed under *Boloria*. They are likewise wholly distinct from all of the variously modified species of the *Argynnis* complex. *Brenthis* is in some respects intermediate between *Boloria* and *Argynnis*, as is further noted below.

Brenthis hecate ([Denis and Schiffermüller])

Figure 22

[DENIS AND SCHIFFERMÜLLER], 1775, p. 179.

SPECIMEN FIGURED: Hungary, genitalic slide no. 79.

Brenthis ino (Rottemburg)

Figure 23

ROTTEMBURG, 1775, p. 19.

SPECIMEN FIGURED: "Europa," *ex* J. Doll collection, genitalic slide no. 249, in the Museum of Comparative Zoology.

Brenthis daphne ([Denis and Schiffermüller])

Figure 24

[DENIS AND SCHIFFERMÜLLER], 1775, p. 177.

SPECIMEN FIGURED: White Capped Mountains, Korea, July, 1933, genitalic slide no. 282.

We see that these Palearctic species are very similar genitalically, and we have not attempted to find separating constancies. As in *Argynnis*, there is a long, spinose crista joining to a free dorsal arm. Centrad and basad on the valves we note all of the sclerotizations which appear in *Argynnis*. The aedeagal lobes are membranous, with the interior armature only delicately sclerotized, and the organ is completely open, basally, as in *Argynnis*. The uncus, however, is similar to the type found in *Boloria*, with divided tip but distinguished by having a third, short, central projection (seen dorsad or ventrad) by which *Brenthis* is separable as a distinct genus.

ARGYNNIS FABRICIUS

Argynnis FABRICIUS, 1807, p. ix. GENOTYPE: *Papilio paphia* Linnaeus, 1758, p. 481, no. 138. FIXATION: Latreille, 1810, p. 440. VALIDATED: 1910, International Commission on Zoological Nomenclature, Opinion 11.

Argyreus SCOPOLI, 1777, p. 431. GENOTYPE: *Papilio niphe* Linnaeus, 1767, p. 785, no. 208 (= *Papilio hyperbius* Linnaeus, 1763, p. 408, no. 75). FIXATION: Reuss, 1928, p. 146.

Issoria HÜBNER, [1819], Verzeichniss bekannter Schmettlinge [*sic*], 2d signature, p. 31. GENOTYPE: *Papilio lathonia* Linnaeus, 1758, p. 481, no. 141. FIXATION: Scudder, 1875a, p. 198.

Acidalia HÜBNER, [1819], Verzeichniss bekannter Schmettlinge [*sic*], 2d signature, p. 31. GENOTYPE: *Papilio niphe* Linnaeus, 1767, p. 785, no. 208 (= *Papilio hyperbius* Linnaeus, 1763, p. 408, no. 75). FIXATION: Scudder, 1875a, p. 101.

Argyronome HÜBNER, [1819], Verzeichniss bekannter Schmettlinge [*sic*], 2d signature, p. 32. GENOTYPE: *Papilio laodice* Pallas, 1771, p. 470. FIXATION: Scudder, 1875a, p. 120.

Argyrea BILLBERG, 1820, p. 77. GENOTYPE: *Papilio paphia* Linnaeus, 1758, p. 481, no. 138. FIXATION: Hemming, 1933a, p. 197.

Damora NORDMANN, 1851, p. 439. GENOTYPE: *Damora paulina* Nordmann, 1851, p. 440 (= *Argynnis sagana* Doubleday, 1847, pl. 21, fig. 1). FIXATION: Original designation monotypic.

In the species of this genus the uncus is never divided but is singly tipped. The valves are more or less complexly sclerotized; the aedeagus is wholly open, basally, and usually very cornute.

We see no possibility of arranging the argynnids into a progressive genitalic series. The related species are easily grouped, but many questions of phylogeny are left unanswered. Aside from the obviously related species there are several that are unique; by the nature of the problem an arrangement must be somewhat arbitrary even when other data are considered along with the genitalic evidence. The present sequence is not defended as being justified by graduated differences in the material; it is hard to see how a complete statement of the relationships could be demonstrated by the genital armature. We offer no definite classificatory proposals but will suggest some groupings in the notes that follow. A formal subdivision of the extreme genitalic heterogeneity into series of anything like comparable value would entail recognition of several small or monotypical genera or subgenera.

Argynnis cytheris (Drury)

Figure 25

DRURY, 1773, vol. 2, p. 7, pl. 4, figs. 3, 4.

SPECIMEN FIGURED: Tofo, Chile, May 26, 1917 (T. Hallinan), genitalic slide no. 291, in the American Museum of Natural History.

It has been impossible to survey the Andean distribution of *Argynnis*. The specific names are based upon single specimens or upon short type series in European repositories. Judging from Lehmann (1913, pp. 426–429, pl. 87), there are only two or three South American entities, with extensive synonymies. Dissections from the short series of *cytheris* in the American Museum of Natural History were studied with much interest. The structural uniqueness which was found is probably no more than is to be expected when the isolation of the habitat is recalled. We are eager to learn if the other Andean species are of similar genitalic type. The relationship, as far as definite placement is suggested, seems to be to the three species that follow. There is a temptation to speculate that these may be very ancient entities.

Argynnis hanningtoni Elwes

Figure 26

ELWES, 1889, p. 558.

SPECIMEN FIGURED: Tumutumu, K[enya] C[olony], October 20, 1861, *ex* Loveridge collection, genitalic slide no. 310, in the Museum of Comparative Zoölogy.

African argynnids are virtually nonexistent in North American collections. Professor Nabokov has lent us specimens of *hanningtoni* from the short series in the Museum of Comparative Zoölogy, along with other substantially helpful loans which we gratefully acknowledge. Professor Carpenter of Oxford University has donated African material for which we are also thankful. Judging from this small accumulation, the African variation is closely related to *gemmata* Butler (1881, p. 32). The insect known as *excelsior* Butler (1895b, p. 729, pl. 44, fig. 4) apparently is a *hanningtoni* subspecies. A dissection of *smaragdifera* Butler (1895a, p. 629, pl. 35, figs. 1, 2) reveals that it is a species distinct from *hanningtoni*, with less prominent aedeagal lobes. It is very similar to *gemmata* in wing pattern and genitalic features.

Argynnis lathonia (Linnaeus)

Figure 27

LINNAEUS, 1758, p. 481, no. 141.

SPECIMEN FIGURED: Darmstadt, Germany (H. Noack), genitalic slide no. 349.

This is the genotype of *Issoria*. The name can be used for the African species and for *gemmata* as well. Although the valve armature of *lathonia* is somewhat more developed, the sclerotizations are found merely in greater degree and not so changed in type as might at first appear. The two spines on the valve terminalia are indicative of *lathonia*. In *Issoria* there is a partly membranous complexity below the uncus which is only suggested in the figures. (Kusnezov [1915, vol. 1, p. cxx] shows this structure in greater detail and calls it a subscaphium. We doubt the applicability of his term.) The spur-like protrusions from the tegumen-vinculum juncture, called the apices angulares by Kusnezov (*loc. cit.*), apparently are a part of the tegumen.

Argynnis gemmata Butler

Figure 28

BUTLER, 1881, p. 32.

SPECIMEN FIGURED: Tibet, genitalic slide no. 276.

Specimens of *altissima* Elwes (1882, p. 403, pl. 25, fig. 8) and of *eugenia* Eversmann (1847, pt. 2, p. 68) have been found to be in close agreement with *gemmata* which would extend the range of this species or species group to include much of Central Asia. One cannot fail to marvel at the distribution presented by the *Issoria* group. Fascinating guesses regarding ancestral *Argynnis* stocks are not intended to be a part of this survey, but the insects of this group, in wing pattern, venation, structure, and distribution, comprise the extreme fringe of the genus to which they belong. They have been placed by past authors wherever thought to be least conflicting but here are seen to be rather closely related.

Argynnis clara Blanchard

Figure 29

BLANCHARD, 1844, p. 20 (Insects), no. 14, pl. 2, figs. 2, 3.

SPECIMEN FIGURED: Tibet, June, 1939, genitalic slide no. 277.

The male genital armature of *clara* is strikingly individual. The narrow, extremely spiculate dorsal arm is characteristic, as is the short, heavily cornute aedeagus.

Argynnis aglaja (Linnaeus)

Figure 30

LINNAEUS, 1758, p. 481, no. 140.

SPECIMEN FIGURED: Darmstadt, Germany (H. Noack), genitalic slide no. 247.

This widespread and variable Palearctic species has a typically distinct genital armature, the uncus, aedeagus, and valves giving quick specific differentiation. The structure of *alexandra* Ménétriés (1832, p. 246, no. 1174) is very similar. This latter insect should be studied to determine whether, despite pattern differences, it may not be an *aglaja* subspecies.

Speculations have been expressed that *aglaja* may be closely related to the Nearctic complex of species, if not their actual progenitor. In our judgment this is not borne out by genitalic analogies. The various offshoots in subfamily development are so genitalically independent that common origins are usually beyond present demonstration. The Tertiary dispersals, fragmentations, and destructions were on so grand a scale that it is barely possible to trace interfamily lines successfully, much less to expect faithful preservation of species linkages.

Argynnis cydippe (Linnaeus)

Figure 31

LINNAEUS, 1761, p. 281, no. 1066.

SPECIMEN FIGURED: "Europa," *ex* Eddy collection, genitalic slide no. 281, in the Museum of Comparative Zoölogy.

The similarity of *cydippe* to the three species that follow will be noted. There are close analogies in the aedeagus, the valve sclerotizations, the peculiar lyre-shaped anellus, and the heavy uncus with its tip prolongation. The present position is suggested by wing superficialities. The genitalic evidence shows only that the species are a group apart from others. No action has been taken by the present reviewers in regard to *nerippe* Felder and Felder (1862, p. 24) or *jainadeva* Moore (1864, p. 131, note), the genital armatures of which seem to resemble *cydippe* in all essential particulars. Experience has indicated that in such instances of close structural relationships a definition of the entities that may be present is impossible without an extensive knowledge of the distributions. There could well be several species represented in Asia.

Argynnis niobe (Linnaeus)

Figure 32

LINNAEUS, 1758, p. 481, no. 143.

SPECIMEN FIGURED: Europe, Imhoff collection, genitalic slide no. 250, in the Museum of Comparative Zoölogy.

The genital armature resembles that of *cydippe*.

Argynnis elisa Godart

Figure 33

Godart, [1823], p. 817.

Specimen Figured: Corsica, *ex* Gunder collection, genitalic slide no. 234, in the American Museum of Natural History.

This insular species is superficially distinct, but there is a close genitalic resemblance to *cydippe* and *niobe*.

Argynnis kamala Moore

Figure 34

Moore, 1857, p. 156, no. 324.

Specimen Figured: Kulu, [Punjab, India], *ex* Weeks collection, genitalic slide no. 312, in the Museum of Comparative Zoölogy.

Here is another admirable instance of the usefulness of the genital armature in pointing out relationships. The superficialities of wing pattern have occasioned the association of *kamala* with *paphia* or with various other species. The actual kinship, which is to *cydippe*, would be hard to believe were it not for the excellent genitalic affinity which is shown. The insect clearly belongs in the *cydippe* group but is specifically distinct.

Argynnis pandora ([Denis and Schiffermüller])

Figure 35

[Denis and Schiffermüller], 1775, p. 176.

Specimen Figured: Sierra de Guadarrama, El Escorial, Spain, 1000 meters, June 24, 1935, genitalic slide no. 97.

The species of *Argynnis* remaining to be discussed are each genitalically unique.

The short, wide, heavily serrate uncus, the distinct aedeagus, and the valves give characters for instant separation of *pandora* and subspecies.

Argynnis paphia (Linnaeus)

Figure 36

Linnaeus, 1758, p. 481, no. 138.

Specimen Figured: Darmstadt, Germany (H. Noack), genitalic slide no. 357.

The long uncus is like that of the *cydippe* group in some respects but has pronounced dorsal serrations. The heavily cornute aedeagus, the spinose bulbous dorsal arm, and the oddly recurved crista are interesting features.

Argynnis sagana Doubleday

Figure 37

Doubleday, 1847, pl. 21, fig. 1.

Specimen Figured: Loutsechiang, Yunnan Province, China, genitalic slide no. 233.

The wings of the female are remarkable in that bands have replaced the usual pattern of spots. The dark color is merely an extension of the suffusion which is hinted at in related species. The wing shape, while apparently modified, is in reality unchanged except in the illusionary exaggeration that the eye receives from the arrangement of color and line. In the males, which preserve the usual *Argynnis* pattern, the genital armature is as distinct as is to be expected, although no more so than in the other unique Palearctic species. The aberrant uncus and the highly individual aedeagus are among the characters that are of interest.

Argynnis childreni Gray

Figure 38

Gray, 1831, p. 33.

Specimen Figured: Hinghwa, Fukien Province, China, October 26, 1921, genitalic slide no. 297, in the American Museum of Natural History.

This insect, the largest and most magnificent in the subfamily, is likewise genitalically so distinct that the figure obviates comment.

Argynnis anadyomene Felder and Felder

Figure 39

Felder and Felder, 1862, p. 25.

Specimen Figured: Kanagawa, Japan (Gulick), genitalic slide no. 321.

The valve sclerotizations differ in detail, although the dorsal arm is distally swollen and spinose as in some other species. The upcurved, simple uncus and the distinct aedeagus give complete specific separation.

Argynnis niphe (Linnaeus)

Figure 40

Linnaeus, 1767, p. 785, no. 208.

Specimen Figured: Chunking, W[est] China, September 17, 1919, genitalic slide no. 231.

By reason of wing pattern differences and because of the tropical distribution, *niphe* has been regarded as hovering on the verge of unrecognizability as an *Argynnis*.

In genital armature apparently it is no more modified than are the other species grouped here. The distal extension of the cucullus is remarkable but the remainder of the armature, although very distinct, is of the *Argynnis* type.

Argynnis laodice (Pallas)

Figure 41

Pallas, 1771, p. 470.

Specimen Figured: Kirin Province, Manchuria, August 3, 1937 (Wing), genitalic slide no. 320.

Argynnis lysippe Janson

Figure 42

Janson, 1877, p. 154.

Specimen Figured: Venoshibe, n[ea]r Sakai, Nippon, July 14, 1937 (Yano), genitalic slide no. 279.

It is interesting to note in the literature how various authors have spoken, now of this species and now of that, as having but dubious placement in *Argynnis*, although *laodice* and *lysippe* seldom attract this degree of attention. In our judgment they are the most pronouncedly divergent species found in all the array of genitalic variations examined. The odd tegumen, weird aedeagus, fluke-shaped anellus, and modified valves seen in these two species preclude further association to other argynnids. The two, although similar and related, are completely distinct in detail, the valves and the aedeagus of each making identification very easy.

SPEYERIA SCUDDER

Speyeria Scudder, 1872, p. 23. Genotype: *Nymp. phal. idalia* Drury, [1773], Index to vol. 1, p. 25, pl. 13, figs. 1–3. Fixation: Original designation monotypic.

Semnopsyche Scudder, 1875b, p. 258. Genotype: *Papilio diana* Cramer, [1777], vol. 2, p. 4, pl. 98, figs. D, E. Fixation: Original designation monotypic.

All of the Nearctic species that have been classified under *Argynnis* are herein considered to belong in a distinct genus for which the name *Speyeria* is available. It is impossible to deny that certain Palearctic groups (those having the *cydippe* type of genital armature, for one example) logically should be given generic status also. No attempt has been made to classify the Palearctic species. We are content that the Old World workers decide their own needs, but we wish to give the Nearctic species the generic recognition to which they seem entitled.

The genus *Speyeria* is confined to North America, as far as we have been able to ascertain, with no close relatives upon the other continents. None of the species resemble *paphia* (the genotype of *Argynnis*) in genitalic structure. A generic character for *Speyeria* is found in the dorsal arm which is a semirectangular plate so distinct in form that a separate term has been used in speaking of it (digitus, fig. 54). The remainder of the armature of *Speyeria* is more conventional in type and is comparatively unspecialized. The anellus is simple, only very slightly varied in form throughout the genus, the valves differ but little, and the aedeagus as well as the uncus is relatively similar in all species. Upon the basis of the male armature, *Speyeria* is singularly homogeneous, although a division that can be made upon evidence of difference in the female armature will be described below.

Speyeria callippe (Boisduval)

Figure 43

Boisduval, 1852, p. 302.

Specimen Figured: Oakland, California, June 12, 1940 (R. J. Wind), genitalic slide no. 328.

Since it is the oldest name, *callippe* is figured to represent a group of Nearctic species which have not yet been found separable by genitalic differences. The species *atlantis* (figs. 52, 54) belongs in this group. The uncus tapers gently to a simple, ventrally curved tip. The digitus is not greatly extended, and the aedeagus is extensively cornute, as in all *Speyeria*. Lest variable details receive too serious attention, it should be emphasized that conclusions will be very unreliable unless based upon extensive material. Oftentimes, a few preparations will seem to show distinctions, which are nullified when more specimens of a given population are examined, and this is even more true of comparisons extended to involve the various subspecies of a major distribution. The foregoing remarks should not be construed as raising doubts about the actual validity of species other than those which separate genitalically, even though the other groups in the subfamily do appear to be subject in large degree to genitalic separation. It is well known that distinguishing characters may be found among species that are genitalically similar, as in this present instance where the species definitions must await an exhaustive marshalling of ecological data which are not within the scope of the present survey.

Speyeria edwardsii (Reakirt)

Figure 44

Reakirt, 1866, p. 137.

Specimen Figured: R[ocky] M[ountain] N[ational] P[ar]k, Colorado, July 21, 1931, genitalic slide no. 324.

This species is the most instantly separable genitalically of the species of *Speyeria*, having in the males a very narrowed and extended digitus. The process is five or six times as long as its breadth, a notable extension since the other species seldom have a digitus more than three times as long as its width. The uncus tapers gently to a claw-like terminus as it does in the large group of which *callippe* is typical.

Speyeria idalia (Drury)

Figure 45

Drury, [1773], Index to vol. 1, p. 25, pl. 13, figs. 1-3.

Specimen Figured: Butler County, Pennsylvania, July 4, 1939 (F. Chermock), genitalic slide no. 343.

This gorgeous insect is distinctive in the male genital armature, although the departure from typical structure is comparatively insignificant and merely of specific value. There can be but little question that *Speyeria* is applicable to the whole Nearctic group, since all of the species agree well in morphology with *idalia* upon which *Speyeria* was founded. The aedeagus presents some modifications, and the outline of the digitus in its distal extension is also constantly indicative of the species. The subterminal ventral excavation in the uncus outline, with only minor variations, is common to *idalia* as well as to the species that follow.

Speyeria nokomis (Edwards)

Figure 46

Edwards, 1862b, p. 221.

Specimen Figured: Round Valley, California, August 4, 1931, genitalic slide no. 326.

Although fairly adequate genitalic distinction is apparent, the characters are minor, to be observed only with close comparative study of series and fully valid only because of their cumulative weight. From *diana*, the species that is closest in point of superficial resemblance, there is positive separation so we know beyond doubt that there can be no possibility of an East-West association in the replacement sense; each is a valid entity. In fact, *nokomis* allies closer with *idalia*, *edwardsii*, and the *callippe* group of species than with *diana*. In the female genital armature, *nokomis* has a simple bursa copulatrix as do the other species of *Speyeria* previously discussed. (Cf. fig. 52, dorsal view of terminal outline, bursa of *atlantis*, typifying the condition prevailing in the species discussed so far.)

Speyeria diana (Cramer)

Figure 47

Cramer, [1777], vol. 2, p. 4, pl. 98, figs. D, E.

Specimen Figured: Gastonia, North Carolina, June 13, 1937 (R. McKenzie), genitalic slide no. 323.

In the male the digitus is characteristic, widening distally by reason of an abrupt ventral angle which in this exact outline is peculiar to *diana* alone. The female bursa is extended by a narrow, tubular connection to a secondary membranous pouch which is long oval in outline and comparatively small. This secondary bursa, along with other features common to the genital armature of both sexes, gives ample evidence that *diana*, *cybele* (Fabricius) (1775, p. 516, no. 311), and *aphrodite* (Fabricius) (1787, vol. 2, p. 62, no. 590) comprise a closely related group. There is some relationship to *nokomis* and *idalia*, seen in the male uncus, although by comparison of the females the two latter species go with *edwardsii* and the *callippe* complex.

This bursal separation should be given due weight since probably it is the most important structural difference to be found among the species of *Speyeria*. Should future reviewers adopt an elaborate classification of the argynnids, *Semnopsyche* could hardly fail to be listed as an independent genus for the species which have a secondary bursa (*diana*, *cybele*, and *aphrodite*).

Speyeria cybele (Fabricius)

Not figured

FABRICIUS, 1775, p. 516, no. 311.

Speyeria aphrodite (Fabricius)

Figures 48, 53

FABRICIUS, 1787, vol. 2, p. 62, no. 590.

SPECIMEN FIGURED: Butler, Pennsylvania, July 24, 1939 (F. Chermock), genitalic slide no. 344.

No figure of *cybele* has been given since the genital armature is so similar to *aphrodite* that constant characters of separation have not been found. Oftentimes, local populations can be identified by careful attention to minor points of variation in the male sex organs and by the difference in characteristic outline of the female bursae, yet, when applied against the whole known range, these are slight and poorly defined differences merely in degree, which have not been accepted as wholly reliable. The best possible morphological separation of these two species continues to be found in the male sex scaling on the veins of the primaries. This is very heavy in *cybele* and its western replacements, while *aphrodite* has the lightest vein scaling observed in any of the species of *Speyeria*. This is constant throughout the range and hence an unfailing character by which all of the subspecies of *aphrodite* and *cybele* may be separated. Attention is called to figures 52 and 53, outlining the dilated female bursae of *atlantis* and *aphrodite*, the contrast showing the *Semnopsyche* group as being distinct from all other related species in North America. (Before the glycerin to water transfer the difference is even more pronounced, since the tubular connection between bursae is much smaller before dilation, and the two bursal sacs are then very distinctly separated.)

EUPTOIETA DOUBLEDAY

Euptoieta DOUBLEDAY, 1848, p. 168. GENOTYPE: *Papilio claudia* Cramer, [1775], vol. 1, p. 109, pl. 69, figs. E, F. FIXATION: Scudder, 1872, p. 22.

We feel under no obligation to work upon this genus. The species of *Euptoieta* are incongruous by venation and by genital armature with Argynninae, being one of several aberrant groups linking to Heliconiinae. Perhaps the dorsal sclerotization upon the male uncus is a generic character; however, the names were not all investigated. The rarer South American representatives should be easy to define as independent species or as subspecies of the two most important, widely distributed, well-known, and genitalically very distinct entities that follow.

Euptoieta claudia (Cramer)

Figure 49

CRAMER, [1775], vol. 1, p. 109, pl. 69, figs. E, F.

SPECIMEN FIGURED: Sand Ridge, Manitoba, August 4, 1935 (J. May), genitalic slide no. 333.

In the valve of the male genital armature, the dorsal process extends to an odd, paw-shaped appendage which bears five long spines and several shorter ones. The anellus is in the form of a Y, with spoon-shaped lobes upon the two upright arms. The aedeagus is distally swollen in outline, roughly bell-shaped in terminus. This short, compressed, and distally enlarged organ is very distinct from the longer, straighter, and more slender aedeagus of the species that follows. The sclerotized bridge upon the dorsum of the uncus is probably specifically distinct in shape.

Euptoieta hegesia (Cramer)

Figure 50

CRAMER, [1779], vol. 3, p. 30, pl. 209, figs. E, F.

SPECIMEN FIGURED: Mapastepec, Mexico, June, 1939 (D. B. Stallings), genitalic slide no. 332.

The uncus is well differentiated from that seen in *claudia*, both in typical outline and in sclerotized dorsal armature. The valves have a similar, paw-shaped dorsal appendage which is smaller, with fewer and much shorter spines. The anellus lobes, extending from a U-shaped formation, are more delicate in sclerotization. The aedeagus will provide diagnosis, as noted above, when contrasted with that organ in *claudia*.

DISCUSSION

It is fortunate that Warren's revision of *Boloria* (1944) was published in time for us to add a short review and a comparison with our views. There has been no exchange of data or collaboration between us; our paper was nearly completed before we learned of his studies. Also, we were unable to follow comprehensively the involved and scattered papers of Reuss. (Warren has performed a notable service in assembling and interpreting Reuss' work.) The fact is, then, that three fully independent genitalic studies of Argynninae have been conducted. Hence, those critics who may be inclined to doubt the value of a genitalic approach to problems of relationship among species and genera should find it interesting to compare the results separately achieved. Instead of summarizing here our present paper, we shall attempt a review of whatever we find of agreement or of disagreement in the conclusions of Reuss, Warren, and ourselves.

Between Warren and Reuss there are some differences in terminology and some disagreements concerning the validity of certain generic names, but there is an impressive similarity of opinion concerning the relationships. In comparison with Warren's revision our present survey differs somewhat in the use of genitalic terms. (We have followed the common usages of American students or have coined descriptive words and phrases where applicable names seemed lacking.) The genitalic groups separated or indicated as distinct by us coincide almost exactly with those recognized by Warren, even, in a number of instances, to exact sequence of species. We have approximately the same ideas of generic sequence. Allowing for some inevitable differences in usage and opinion, the agreement in these separate investigations confirms the validity of certain of the outstanding inferences shared in common.

The most important of these generalizations is that the close similarity of wing pattern throughout Argynninae is a subfamily (not a generic) characteristic. These similar appearing insects have been found to be separable by many structural differences. In view of the uncertainty of past workers as to the limits of *Argynnis* and *Brenthis* (unrestricted), this alone is a startling discovery. Warren believes that the genera are rather widely separate, in an evolutionary sense, and follows Reuss in exploiting the genitalic differences to the fullest. This results in the recognition of numerous small genera, especially for the Palearctic species, which are seen to differ so greatly in genital armature.

In formulating a genitalic separation, Warren (1944, p. 6) follows Reuss in stating that the following characters are ". . . common to all species of Argynnids and peculiar to them: (1) the presence of a non-chitinised area in the dorsal region of the 9th tergum, and (2) the fact that the terminal (distal) process of the harpe lies external to the clasper." (In comparison of descriptions Warren's term "head of the harpe" applies to the dorsal process termed "valvenflagellen" by Reuss and "dorsal arm" by us. Warren further considers that the dorsal lobe, the crista, and the dorsal arm, as we use the terms, compose the "harpe" as distinct from the claspers, or lower portion of the valve.)

As far as we have been able to check them, these structural peculiarities will go far toward isolating Argynninae. We recently investigated *Basilarchia*, finding it to be fully distinct and not at all an argynnid type. However, *Euptoieta* proves to be curiously intermediate, as we have observed heretofore. The tegumen does not have the dorsal membranous area, but the dorsal process of the valve is analogous to *Argynnis* in situation. Thus, the position of *Euptoieta* is probably approximately as we have placed it. We believe that we are correct in concluding that the subfamily most nearly related to Argynninae is Heliconiinae, with a few traces of persisting structural linkage. Therefore, aside from the possibility of a very few intermediate American species, the genitalic features of the membranous area located dorsocentrally on the tegumen and the dorsal process exterior to the lower portion of the valve should prove to be faithfully diagnostic for the present subfamily. Warren agrees that the *Melitaea* group of genera are not to be associated with Argynninae.

As to the details of a classification for the Palearctic argynnids, we repeat that we are content that the Old World workers decide their own needs. For the convenience of American students who may not have access to Reuss' and Warren's papers, we give an outline of the genera they use, as listed by Warren (1944, pp. 26–30).

Issoria Hübner for *lathonia, gemmata,* and the African species.

Fabriciana Reuss (1920, p. 192) for the species we termed the *cydippe* group. Reuss designated *Papilio niobe* Linnaeus as the genotype.

Neoacidalia Reuss (1926a, p. 69) for "... according to Reuss (1926), four Asiatic and thirty-four American species." Reuss designated "*Papilio cybele* Cramer" [*sic*] as the genotype.

Mesoacidalia Reuss (1926a, p. 69) for the designated genotype *aglaja,* also *alexandra* and related species, with *clara* placed in subgenus *Proacidalia* Reuss (1926a, p. 69).

Argynnis Fabricius for *paphia.*

Pandoriana Warren (1942, p. 246) for *pandora,* with genotype designated as *Papilio maja* Cramer ([1775], vol. 1, p. 39, pl. 25, figs. B,C) (= *pandora* [Denis and Schiffermüller]).

Childrena Hemming (1943, p. 30), a new name for the homonym *Eudryas* Reuss (1926b, p. 253) for *childreni,* the designated genotype.

Argyreus Scopoli for *niphe.*

Damora Nordmann for *sagana.*

Argyronome Hübner for *laodice.*

We venture no comment upon the purely Palearctic classification other than to point out that we arrived at an extremely similar grouping and arrangement of groups. We agree that *Issoria* and *Fabriciana* are ancient and suggest that in a world list *Speyeria* might well follow *Issoria* and precede *Fabriciana,* also that the South American species may comprise a genus which should head such a list. Of course, there is no actual kinship shown other than that in the argynnids these groups agree in the relative simplicity of genitalic structure; also, the dispersals correlate with what is known of certain Tertiary mammalian distributions, giving basis for speculation that these genera had early distinctness.

We do not see how *Neoacidalia* Reuss can apply to any American species. By genitalic limitations the only recognizable Nearctic groups fall under Scudder's prior names, i.e., *Speyeria* and *Semnopsyche.* Any genus with *cybele* as its genotype would be a synonym of *Semnopsyche* with genotype *diana.* The similar armature in all Nearctic species raises doubts if generic elaboration is called for. We know of no Asiatic *Speyeria.*

Warren follows Reuss in limiting *Brenthis* Hübner to the *hecate* group with exactly the same species and the same generic characters mentioned by us. This restriction of *Brenthis* is a necessity and must stand, however greatly workers may deplore the change in long-established usage. Its retention in a wider sense would be to continue a grave error in associations.

Warren's monograph proper is concerned only with *Boloria* Moore which he restricts to the *pales* group. He distinguishes three species, genitalically separable, in the forms hitherto associated with *pales,* and asserts that the Nearctic races fall under *napaea* Hoffmansegg (1804, p. 196). In his review of genera he has placed *aphirape* in the genus *Proclossiana* Reuss[1] (1926a, p. 69) and all of the remaining species herein listed as *Boloria* under *Clossiana* Reuss.

We believe that this treatment of *Boloria, Proclossiana,* and *Clossiana* is open to some difference of opinion. We realize that the staggering task of revising the world species which Reuss and Warren place in *Clossiana* may be delayed for many years, and in the meantime data essential to a final estimation of the subfamily are missing. Hesitancy is further prompted by the fact that an intensive study of the female armature in Argynninae might do much toward deciding if the variation in the male genital armature can be used alone as a basis for generic separations. Some allowances might have to be made if a series of uniformities in the former sex were found. If the arguments for numerous small genera, amply documented by three independent genitalic surveys of the males, were further borne out by characters in the genitalic armature of the females, the conclusions of Reuss and Warren could hardly fail to be accepted. Pending further data we see no reason why the name *Boloria* cannot be used in a loose sense by American students to replace the name *Brenthis* which has been lost to the Palearctic fauna. Specialists may wish to use the several restricted genera, but in our opinion *Clossiana* contains a genitalic diversity in which there are groups comparable in value to *Boloria* (restricted) and *Proclossiana.* Apparently, still more genera will be required if Reuss' concepts are to prevail.

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[1] Warren has asked us to point out that his reference to the original description of this genus is not correct.

All of the species that we placed in *Boloria* agree in possessing the bifid uncus and the basally closed aedeagus. The latter feature was not emphasized by Warren because, he says (*in litt.*), it is found in other Lepidoptera. Still, within the present subfamily it is remarkable and may be used along with the bifid uncus and simple valve as a character by which *Boloria* is distinct from all other argynnids, including *Brenthis.* An integrating category, not expressed by the several genera in the concepts of Reuss and Warren, would be justified because of likenesses seen throughout *Boloria* (unrestricted). We agree with those authors that in propounding a classification for Argynninae the great diversity in male genital armature should be considered. However, it would seem essential not to lose sight of gross differences and similarities while pointing out the special characters of species and species groups. Until further data are secured, differences in opinion may be allowed, our opinion being that the invariable similarity of structure of the aedeagus would alone justify the use of subgenera under *Boloria* rather than to recognize several restricted genera. The isolation of groups which is implied by the latter classification may be close to the truth in an evolutionary sense, but the fact of genitalic similarity weighs against the variation which is found.

CONCLUSION

By this survey and by what has been said concerning the views of Reuss and Warren, American students of Argynninae will see that *Brenthis* and *Argynnis* should be restricted to Palearctic species. The genitalic peculiarities of *Brenthis* set it apart from the Holarctic species for which the name *Boloria* (unrestricted) is available. In *Boloria,* the bifid uncus and basally closed aedeagus provide genitalic characters for a basic separation. For many of the species there are nomenclatorial and distributional problems, involved through circumpolar dispersals, complicating the difficulties of morphological studies which are needed before final estimations can be made of classificational requirements. Perhaps *Boloria* will require several genera or subgenera, along lines indicated by Reuss. The primary separation from other major groups in Argynninae may be said to be complete and satisfactory. The group of larger species usually termed argynnids are found to be greatly varied in genitalic structure. Specialists concur upon the desirability of recognizing numerous genera. Among these genitalically isolated groups, *Speyeria* has outstanding peculiarities which are shared by all Nearctic species. It has been demonstrated that the prevailing uniformity of wing pattern in the subfamily is wholly unusable as an indicator of generic relationships. The genitalic distinctness of *Speyeria* as compared to *Argynnis* gives ample warrant for the generic separation and is yet another in a series of proofs of the evolutionary gulfs separating the genera in Argynninae. With the isolated position of *Speyeria* thus demonstrated, it is obvious that revisional studies of Nearctic species may proceed without need of further reference to species upon other continents.

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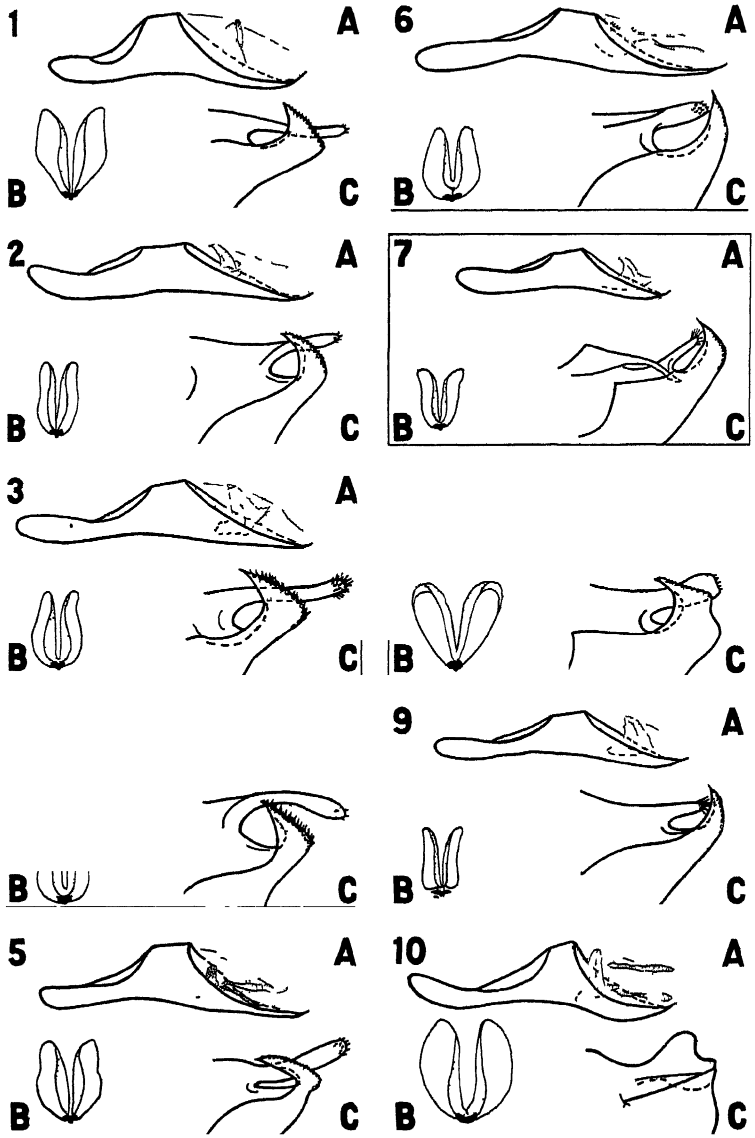
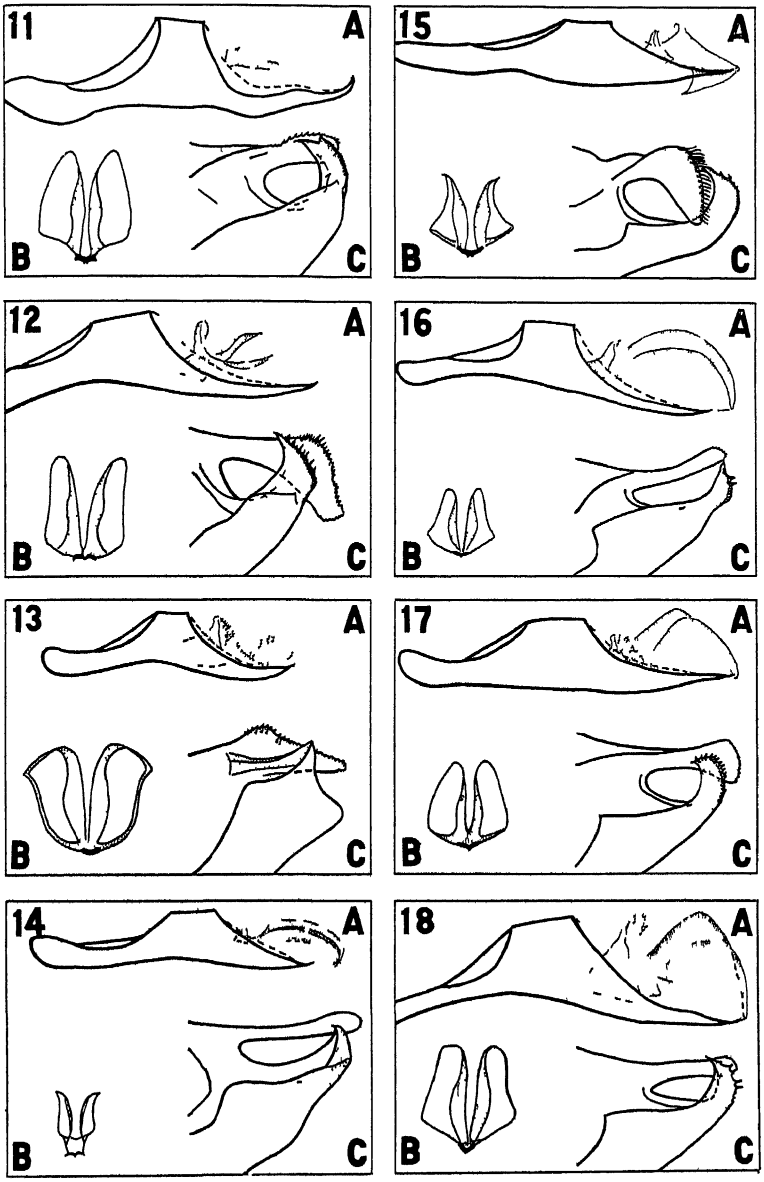
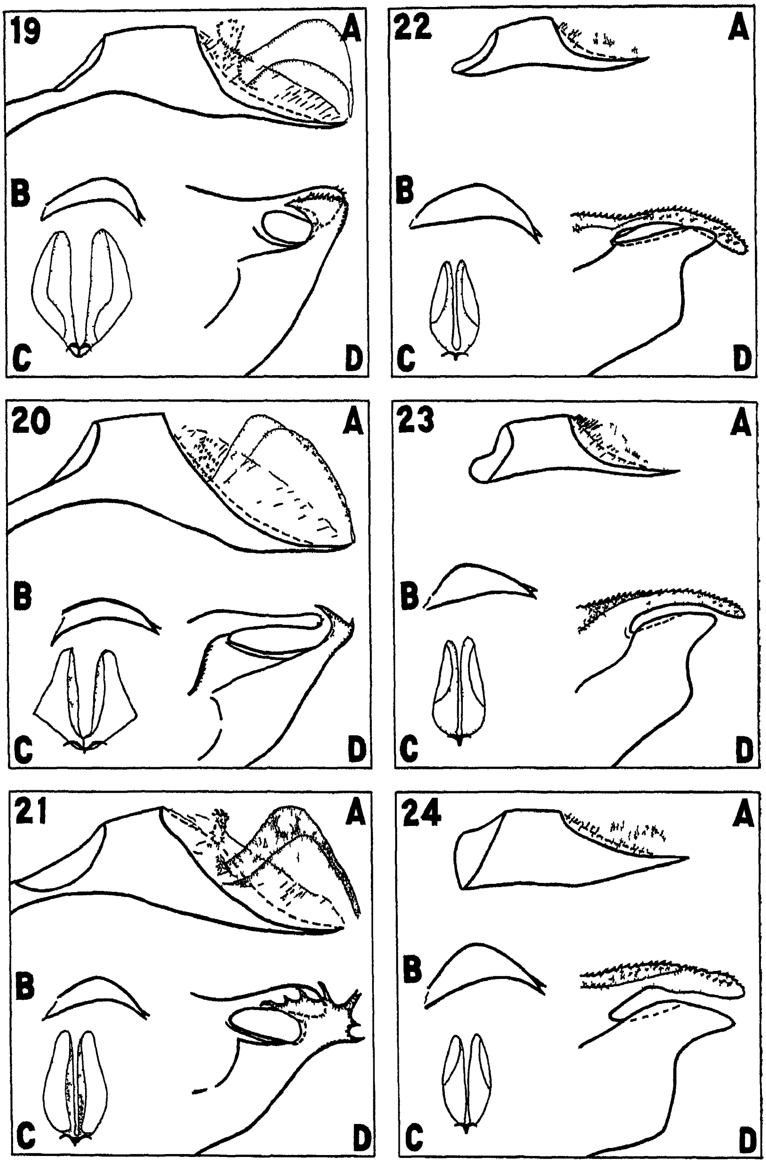


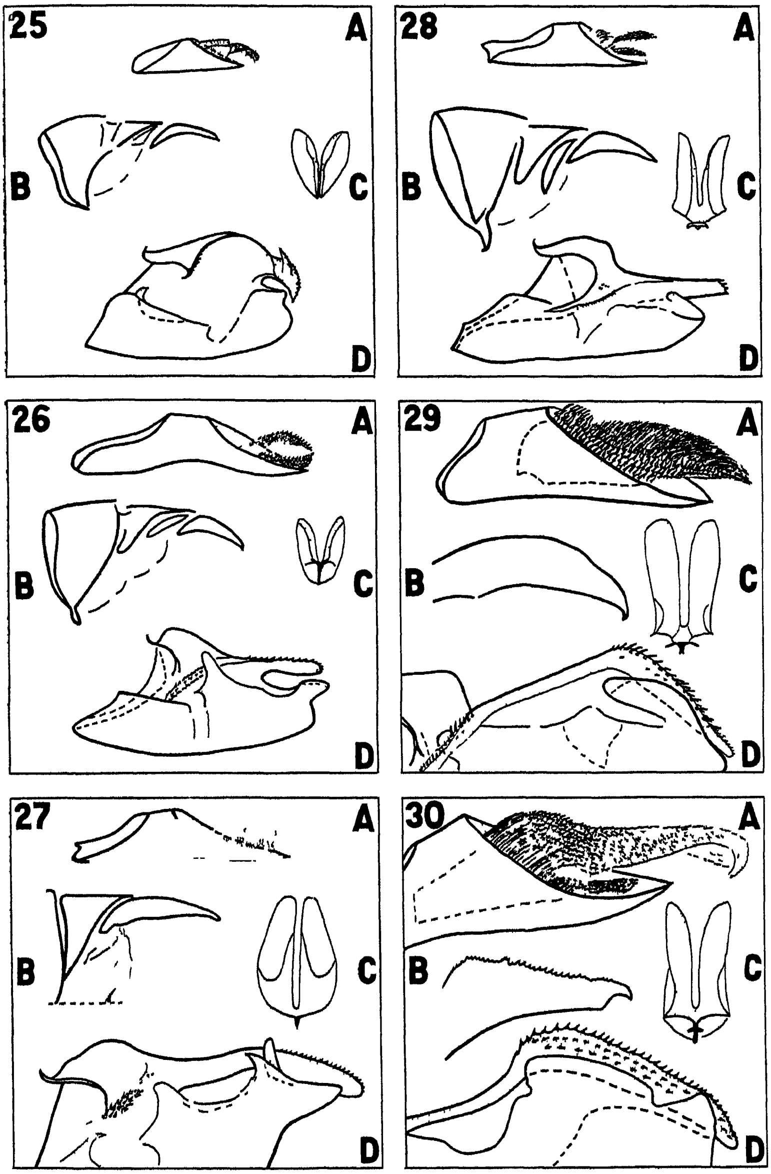
Figs. 1–10. Male genitalia, *Boloria*. A, Aedeagus, B, anellus; and C, valve terminalia of (1) *thore*, (2) *improba*, (3) *frigga*, (4) *toddi*, (5) *selene*, (6) *polaris*, (7) *jerdoni*, (8) *gong*, (9) *haberhaueri*, (10) *aphirape* Enlarged about 22×.



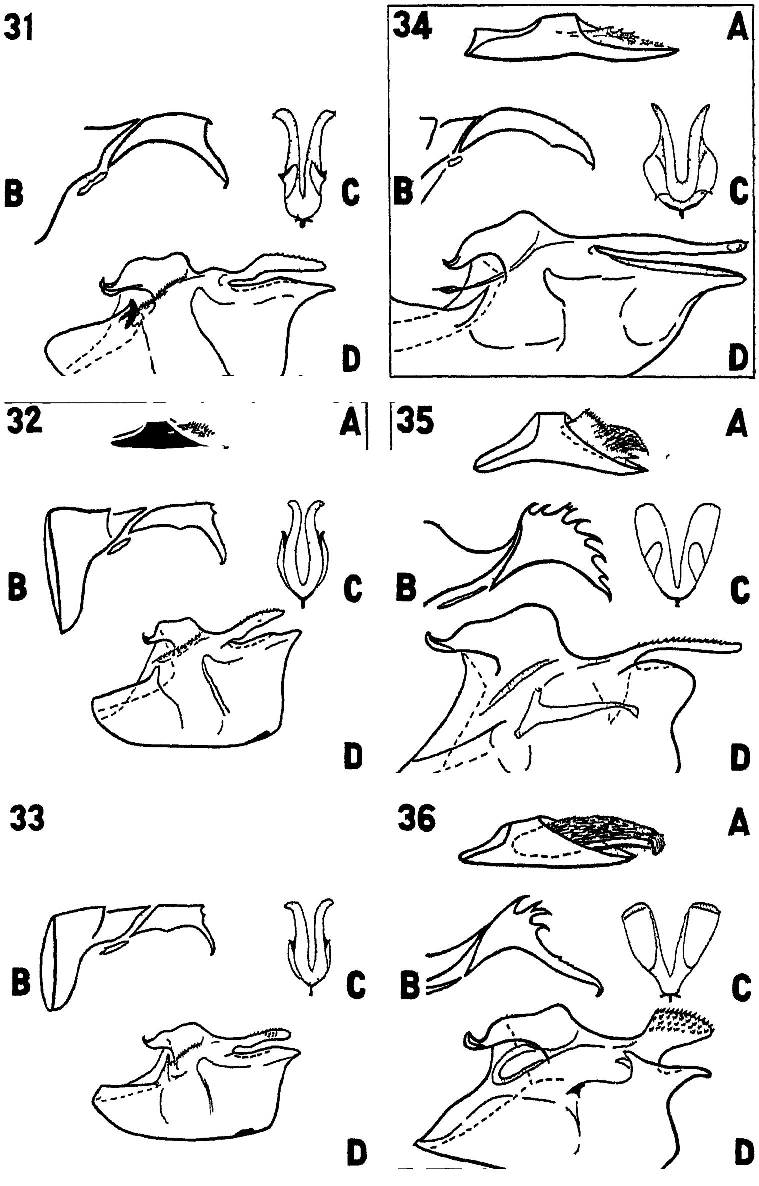
Figs 11–18 Male genitalia, *Boloria* A, Aedeagus, B, anellus, and C, valve terminalia of (11) *alberta*, (12) *amphilochus*, (13) *pales*, (14) *dia*, (15) *freija*, (16) *selenis*, (17) *euphrosyne*, (18) *chariclea* Enlarged about 22×



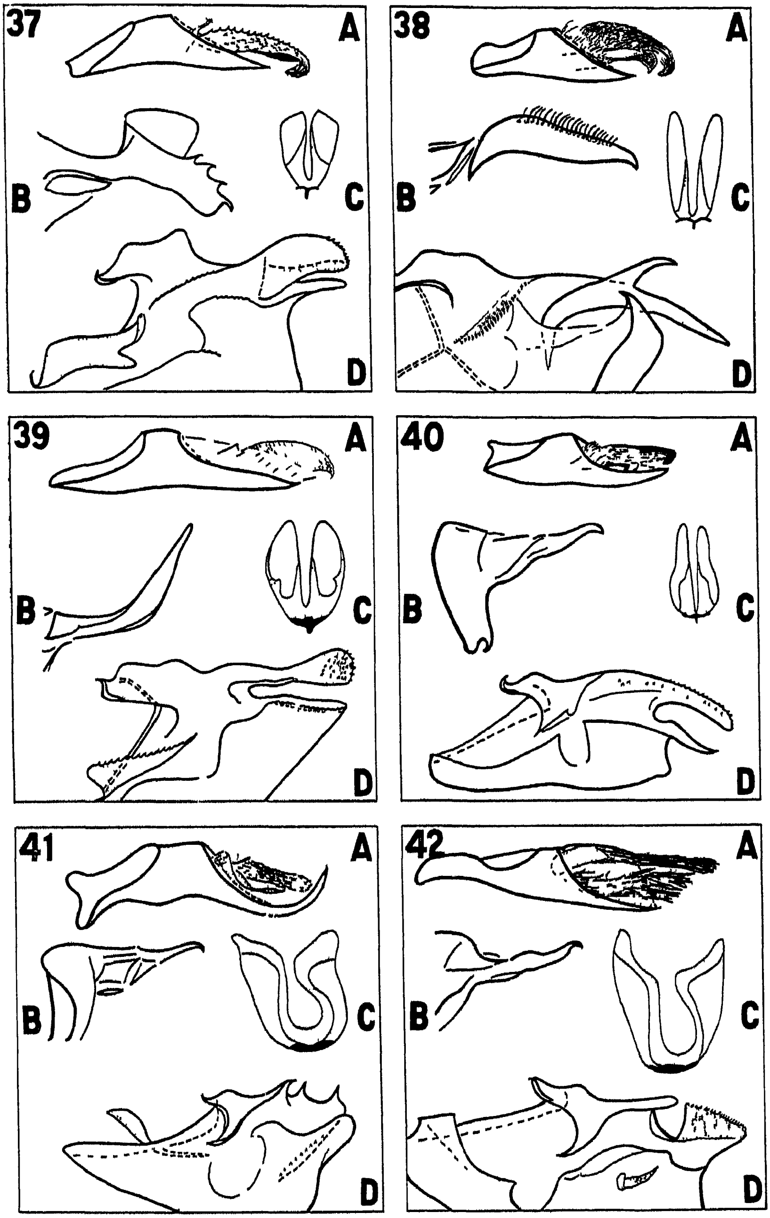
Figs. 19–24. Male genitalia, *Boloria* and *Brenthis*. A, Aedeagus; B, uncus; C, anellus; and D, valve terminalia of (19) *Boloria rossicus*, (20) *oscarus*, (21) *angarensis*, (22) *Brenthis hecate*, (23) *ino*, (24) *daphne*. Enlarged about 22×.



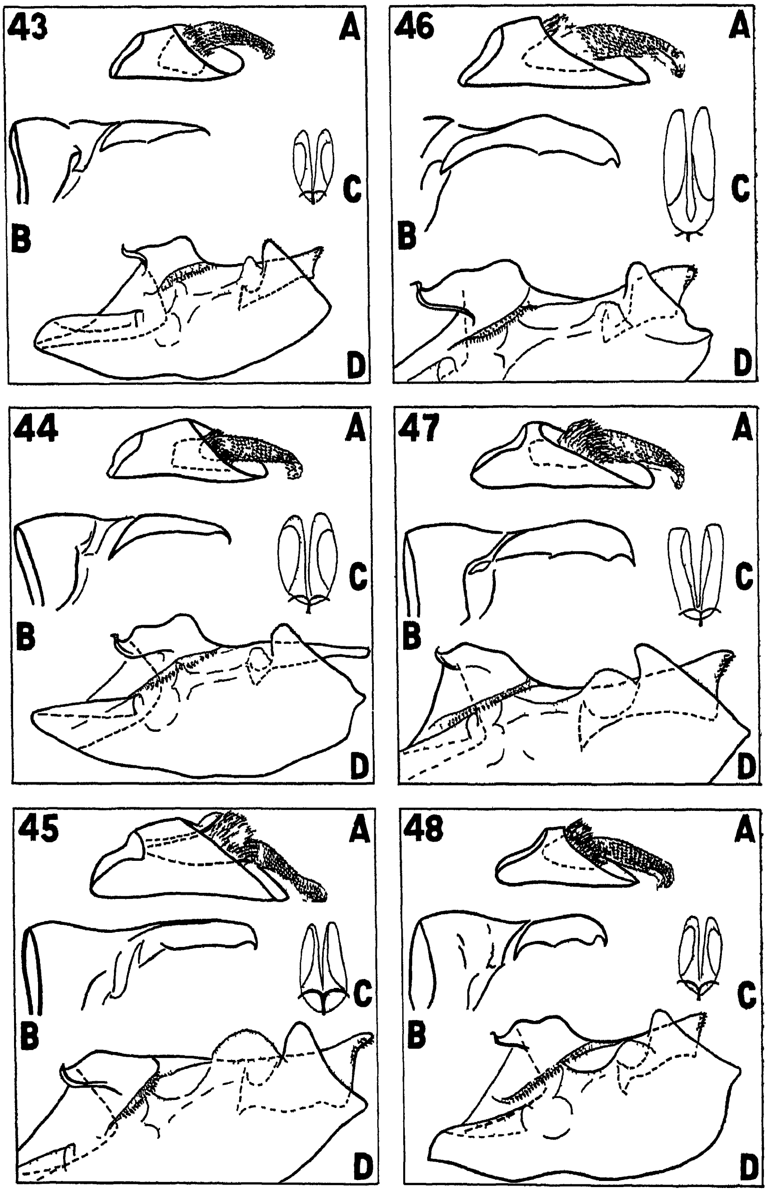
Figs. 25–30. Male genitalia, *Argynnis*. A, Aedeagus; B, uncus; C, anellus; and D, detail of valve of (25) *cytheris*, (26) *hanningtoni*, (27) *lathonia*, (28) *gemmata*, (29) *clara*, (30) *aglaja*. Enlarged about 22×.



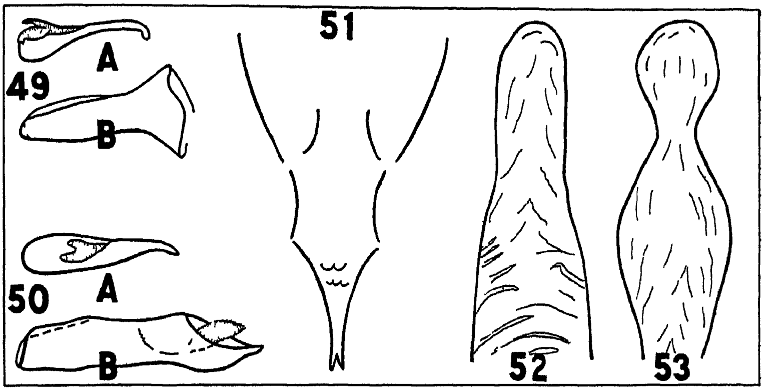
Figs. 31–36. Male genitalia, *Argynnis*. A, Aedeagus, B, uncus; C, anellus; and D, detail of valve of (31) *cydippe*, (32) *niobe*, (33) *elisa*, (34) *kamala*, (35) *pandora*, (36) *paphia*. Enlarged about 11×.

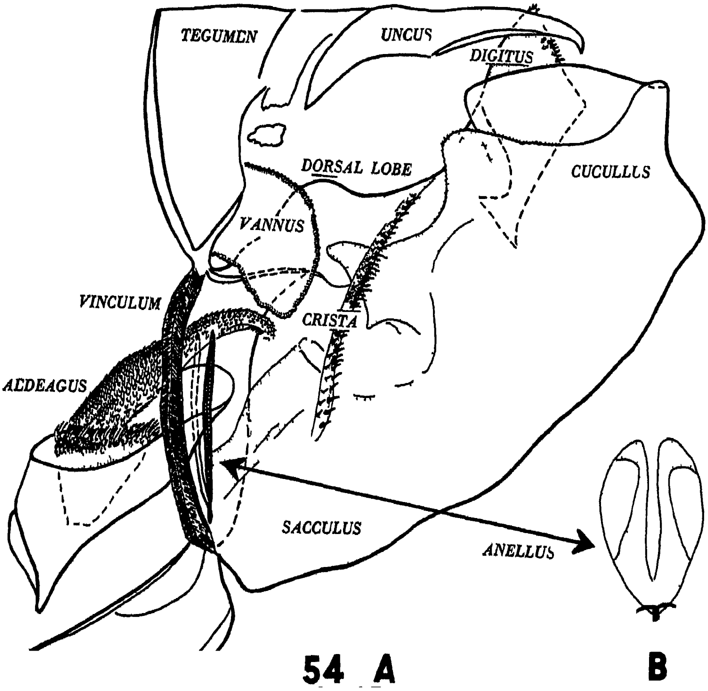


Figs. 37-42. Male genitalia, *Argynnis*. A, Aedeagus; B, uncus; C, anellus; and D, detail of valve of (37) *sagana*, (38) *childreni*, (39) *anadyomene*, (40) *niphe*, (41) *laodice*, (42) *lysippe*. Enlarged about 11×.



Figs. 43–48. Male genitalia, *Speyeria*. A, Aedeagus; B, uncus; C, anellus; and D, detail of valve of (43) *callippe*, (44) *edwardsii*, (45) *idalia*, (46) *nokomis*, (47) *diana*, (48) *aphrodite*. Enlarged about 11×.





Figs 49–54 Genitalia of Argynninae A, Uncus, and B aedeagus of (49) *Euptoieta claudia* and (50) *Euptoieta hegesia*, dorsal view of uncus of (51) *Boloria selene* dilated bursal terminalia, females of (52) *Speyeria atlantis* and (53) *Speyeria aphrodite* lateral view of the left side, left valve removed full male armature of (54A) *Speyeria atlantis* with terminology used and (54B) separate cephalad view of anellus the arrow pointing to its lateral position when *in situ* Enlarged about 22×.

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A NEW SPECIES AND SOME NEW SUBSPECIES OF *SPEYERIA* (LEPIDOPTERA, NYMPHALIDAE)

BY CYRIL FRANKLIN DOS PASSOS AND LIONEL PAUL GREY

The new names proposed in this paper will be included in our systematic catalogue of the Nearctic genus *Speyeria* Scudder (1872, p. 23) which is to be published later. That paper will list all of the species and subspecies in revisional sequence. We have also in preparation a series of monographic papers discussing the subspeciation of the various Nearctic entities. Therefore, remarks under the present descriptions are limited to brief notes establishing classificational positions.

Speyeria wenona, new species

Figures 1, 2

Above, the males are paler in ground color than *nokomis nokomis* (W. H. Edwards) (1862b, p. 221) with finer black pattern. All of the usual spots, lines, and dashes are similar to the pattern found in *nokomis* but are reduced in size and intensity. The outer marginal interspaces between the nervules are especially light in contrast with *nokomis,* and the white fringes show more distinctly. The females are very different from that sex of *nokomis,* lacking the solid brownish black basal suffusion and the contrast thereby gained with the straw-colored band of the outer third of the wings. In *wenona* the ground is nearly concolorous throughout in both sexes with only the limited basal suffusion common to the genus. In the apical area of the primaries of the female the underside silver areas appear above as whitish spots. In *nokomis* these spots are concolorous with the band.

Below, the males are similar to *nokomis* except that the discal area of the secondaries is overlaid basally with light olivaceous green. This greenish overcast is occasionally suggested in *nokomis* but seldom emphasized, the males of the latter insect having but little contrast between the disk and the band except in the montanic subspecies *nokomis nitocris* (W. H. Edwards) (1874, p. 15) where the disk becomes brown. The females of *wenona* are also green in the discal area, rather like females of *nokomis.* The smaller size, reduced pattern, and paler ground in both sexes and the comparative lack of color contrast in the females give instant separation from all *nokomis* variations hitherto named.

EXPANSE: Holotype 59 mm., allotype 62 mm. (*nokomis* 65 to 78 mm.).

TYPE MATERIAL: The holotype male and allotype female were taken, *in copula,* in a subalpine meadow, 12,000 feet, Cerro Potosi, Municipio de Galeana, Nuevo Leon, Mexico, July 18, 1938, by R. A. Schneider. They are in the American Museum of Natural History.

REMARKS: This species belongs nearest to *nokomis nokomis* by male and female genitalia; by the simple female bursa it is apart from the *Semnopsyche* group (dos Passos and Grey, 1945, p. 13); and by the male armature, especially the ventrally excavate uncus outline and large digitus, it is distinct from the species group headed by *callippe* (Boisduval) (1852, p. 302). In a superficial aspect, *wenona* is suggestive of *nokomis* but in view of our present ignorance of Mexican distributions, it is described as a distinct species. It is quite unlike anything previously named.

Speyeria cybele letona, new subspecies

Figures 3, 4

Argynnis leto, COMSTOCK, 1927, p. 81, pl. 23, fig. 6, female.

Argynnis leto ab. *letis*, COMSTOCK, 1927, p. 82, pl. 23, fig. 8, male.

Above, both sexes are similar to the subspecies *cybele leto* (Behr) (1862, p. 173). The males average smaller, with lighter ground. They are well suffused and heavily marked in discal areas but very noticeably clearer and less spotted in the submarginal band. The in-pointing, black, submarginal lunules of the secondaries, which are conspicuous in *leto*, are much reduced and indicated by light dashes rather than by heavy crescentic markings, and there is likewise considerably less black scaling accenting the nervule endings. This subduing of pattern makes the outer third of the wings appear lighter than in *leto*. The females are not so boldly marked, the black is not quite so intense, the size averaging a trifle smaller and the submarginal markings reduced and less crescentic, giving emphasis to the wide light band. In these minor respects they are slightly different from *leto* yet closely similar. It is in the males that the variation from *leto* is greatest.

Below, in the males, the enclosed submarginal lunules are little silvered or not silvered at all, while in *leto* these spots are usually well silvered. The disk of the secondaries is duller brown, the usual spots are well silvered approximately as in *leto*, but the submarginal areas again differ because of reduction in pattern intensity. The females vary similarly; the lunular submarginal row of spots is silvered but reduced to mere dashes.

EXPANSE: 60 to 65 mm., holotype 63 mm.

TYPE MATERIAL: The holotype male and allotype female are from City Creek Canyon, Salt Lake City, Utah, 4500 feet, July 17, 1939 (W. L. Phillips, L. P. Grey collection). There are 41 paratypes as follows: 24 males and 12 females, same locality and collector, July 5–August 24, 1939–1943 (L. P. Grey collection); 4 males, Mill Creek, American Fork Canyon, Utah County, Utah, August 6, 1932 (*ex* J. D. Gunder collection); 1 male, Ogden, Utah, July 25, 1920 (*ex* J. D. Gunder collection). The holotype, allotype, and a series of paratypes are in the American Museum of Natural History. The other paratypes are in the collections of the authors.

REMARKS: This is a Great Basin subspecies, relating to *leto*. The type locality of *leto* is near Carson City, Nevada. In a dispersal through the northwest to and down the Rocky Mountains there is relatively little variation. In northern Colorado, however, significant changes begin. The transition through the southern Rocky Mountain areas shows adequate linkage of *leto* to *cybele* (Fabricius) (1775, p. 516) in unnamed colonies from *charlottii* (Barnes) (1897, p. 39) to *carpenterii* (W. H. Edwards) (1876, p. 204), while in the mountainous portions of the Great Basin *letona* is prevalent westward, distinct from the darker, more heavily patterned specimens typical of the more northern distribution.

W. L. Phillips (*in litt.*) offers the following notes upon the type locality: "Males are common in most of the lower elevations of the canyons of the Wasatch Range on the east of Salt Lake Valley, from early June until September. Some fly until frost. The females are quite plentiful for about ten to fifteen days in late June or early July but only in sections of City Creek, Mill Creek, Lambs and some of the other canyons; after that time they seem to spread out over more territory, are harder to find and in poor condition."

J. A. Comstock's figure (1927, pl. 23, fig. 8) of *letis* (Wright) (1905, p. 130, pl. 12, fig. 111, male) is an excellent color photograph of *letona*. This Provo, Utah, specimen is not *letis*, a name which was originally applied to a light aberration of *leto* from the Coast Range of northern California.

Speyeria coronis simaetha,

new subspecies

Figures 5, 6

Above, both sexes are similar to *coronis snyderi* (Skinner) (1897, p. 154) but much smaller and with corresponding pattern reduction. The 65 to 75 mm. topotypical *snyderi* from Salt Lake City, Utah, is greatly varied in ground color from ruddy to quite pallid brown, while *simaetha* is more consistently intermediate.

Below, both sexes vary like *snyderi* but are probably less extreme in color changes.

In the latter subspecies the disk may be any shade from deep brown to olivaceous green. In *simaetha* the disk is sordid light olivaceous brown varying to a greener tint. Females of these subspecies tend to be greenish below, the males more brown, but in some individual specimens this does not hold true. The band in *simaetha* is narrowed and darker with less clarity both of definition and of color. The differences between the sexes are the usual argynnid characters of accented pattern and more rounded primaries in the females.

EXPANSE: 53 to 60 mm., holotype 54 mm.

TYPE MATERIAL: The holotype male is from Black Canyon, Cascade Mountains, near Brewster, Washington, June 25, 1939, and the allotype female is from the same locality, July 20, 1940 (J. C. Hopfinger, L. P. Grey collection). There are 7 paratypes as follows: 2 pairs, same locality and collector, June 10–July 20 (L. P. Grey collection); 3 males, same locality and collector (C. F. dos Passos collection). The holotype and allotype are in the American Museum of Natural History. The paratypes are in the collections of the authors.

REMARKS: A study of extensive material has convinced us that the fluctuations of *garretti* (Gunder) (1932, p. 282) relate to the species *zerene* (Boisduval) (1852, p. 303) rather than to the species *coronis* (W. H. Edwards) (1864b, p. 435). The latter view has long been held by many American students, including ourselves (1942, p. 4). On the basis of this revised estimate of fundamentally important relationships, *snyderi* is now considered to be the Great Basin subspecies of *coronis*, with *halcyone* (W. H. Edwards) (1869a, p. [81]) intergrading but becoming a distinct subspecies of *coronis* in the Rocky Mountains. A detailed account of the linkages from *coronis snyderi* to *coronis coronis* is postponed to a later paper. The newly described subspecies, *simaetha*, is endemic in the Cascade Ranges. In common with companion species of *Speyeria* and butterflies of other genera, a relative stability is achieved in those mountains. However, excessive variation occurs in the colonies that are found from Oregon to the California mountains, also in the Great Basin mountains to the Rocky Mountains, the other major path of Canadian and Transition Zone dispersal and subspeciation.

Speyeria zerene myrtleae,
new subspecies

Figures 7, 8

Above, both sexes resemble *zerene behrensii* (W. H. Edwards) (1869b, p. 370) both in size and in appearance except for a lighter ground color against which the markings show more conspicuously and the enclosed or partly enclosed mesial and submarginal areas are more contrastingly defined. The basal suffusion is more noticeable against the lighter ground.

Below, both sexes are paler than *behrensii*, and are light tan and light, delicate reddish brown rather than the bold, heavy ruddy brown of *behrensii*. The pattern is the same although less distinctive because of the lighter color. The usual spots are well silvered throughout but not so prominent due to the less contrasting background.

EXPANSE: 54 to 56 mm., holotype 56 mm.

TYPE MATERIAL: The holotype male is from San Mateo, California, July 27, 1919, and the allotype female is from the same locality, August 10, 1919. There are 5 paratypes as follows: 1 male and 4 females from the same locality, August 10–24. All were collected by W. F. Breeze and are in the American Museum of Natural History.

REMARKS: In the Shasta Gap region of northern California there is much variation pointing from the Sierran cline of *zerene* and culminating in isolated rare coastal colonies, of which we have records from most of the counties north of San Francisco Bay. It is expected that *myrtleae* from south of the bay will be a great rarity, very locally confined and sporadic in occurrence, as is usual with species representatives that are struggling on a marginal fringe of the distribution. Whenever a collector finds a colony of these coastal rarities he may count it a fortunate day, whether it be the classic *behrensii* in its Mendocino County strongholds or similar variants of even greater interest from the other coastal counties. The stock seems to increase in rarity in proportion to the extent of its southerly penetration. San Mateo County may prove to be its utmost limit. Our records of this coastal cline are mostly from 20 to 30 miles inland.

Speyeria zerene sinope, new subspecies

Figures 9, 10

Above, both sexes are similar to *zerene garretti* but are much smaller, with pattern correspondingly reduced, more intensely black, and with slightly less basal suffusion. The ground color of the males, in series, is noticeably a redder shade of brown than is usual in *garretti*.

Below, both sexes vary greatly, as is to be expected in this species. The submarginal band is usually wider, lighter, and clearer, and the silvered spots are more pronounced against a more solidly olivaceous brown disk than in *garretti;* also the half-inch difference in wing expanse is quite constant. From *zerene platina* (Skinner) (1897, p. 154) the males are readily separable by reason of darker color throughout and obviously are a montanic race. The females vary toward being lighter, some specimens approximating *platina*, but normally agreeing with the males in having the darker aspect and more sharply defined pattern brilliancy.

EXPANSE: 50 to 55 mm., holotype 53 mm.

TYPE MATERIAL: The holotype male and allotype female are from Rocky Mountain National Park, Colorado, 8000 feet, collected by Roy Weist (L. P. Grey collection) in the Estes Park area, July. There are 42 paratypes as follows: 12 males and 30 females with the same data. The holotype, allotype, and a series of paratypes are in the American Museum of Natural History. The other paratypes are in the collections of the authors.

REMARKS: The distinct populations occurring in the Colorado Rockies constitute one of the major trends observable in North American butterfly subspeciations. The variation in western and northern Colorado is great, but in a large area in and near the Front Range the material shows relative stability. To the already large number of named Colorado butterfly subspecies we add *sinope.* It is typically so unlike named subspecies that a separate recognition seems desirable. The southern extent of this distribution remains to be explored. We have seen specimens from New Mexico which are like *platina.* Extensions of *sinope* to the Black Hills and to western Nebraska may be expected.

Speyeria zerene cynna, new subspecies

Figures 11, 12

Above, both sexes are like *zerene platina* with somewhat lighter markings, more unicolorous ground, and more limited basal suffusion.

Below, both sexes are lighter than *platina*, many specimens having the disk of the secondaries almost concolorous with the pale straw band. There is no rosy suffusion at the base of the primaries, and in all respects this is a strikingly pallid *Speyeria.*

EXPANSE: 50 to 55 mm., holotype 52 mm.

TYPE MATERIAL: This insect is described from a type series of 25 males and 9 females, all from Ruby Valley, Elko County, Nevada, as follows: holotype male, Humboldt National Forest, 1931–1932 (E. Schiffel, *ex* J. D. Gunder collection), and allotype female, Wright's Ranch, July 12–24, 1931 (*ex* J. D. Gunder collection). There are 32 paratypes as follows: 10 males and 6 females, July 12–26 (*ex* J. D. Gunder collection); 3 males and 1 female, July 12–24 (C. F. dos Passos collection); 12 males, various collectors and dates, June 12–July 16 (L. P. Grey collection). The holotype, allotype, and a series of paratypes are in the American Museum of Natural History. The other paratypes are in the collections of the authors.

REMARKS: This is the form that is widely distributed in collections under the name *gunderi* (Comstock) (1925, p. 67). As previously stated by us (1942, p. 4), we believe that true *gunderi* from Buck Creek, Modoc County, California, is a local population of extremely light *coronis snyderi* and thus belongs to a species complex distinct from the *zerene* subspeciations although amazingly like *cynna* in nearly all of the superficialities. However, even in the Buck Creek locality, specimens do not average so light as Comstock's figures of the types (1927, pl. 27, figs. 4, 5, 6), and in nearby regions there is full transition to the darker Sierran *snyderi*, so called, of the east slopes. Comstock's figures are reduced, as the males before us from the type catch measure 65 mm., a half inch larger than *cynna*. The classification under *zerene* demands explanation at somewhat greater length than is convenient in this paper. Briefly, we trace through *platina* and *garretti* via *picta* (McDunnough) (1924, p. 43) to *bremnerii* (W. H. Edwards) (1872, p. 63) and thence across the Shasta Gap to the Sierran cline.

Speyeria callippe elaine, new subspecies

Figures 13, 14

Above, both sexes are similar to *callippe rupestris* (Behr) (1863, p. 84) but are larger. The dark ground, deep basal suffusion, heavy pattern, and heavily scaled veins are characteristic of these subspecies.

Below, both sexes are obscurely to brilliantly silvered. The usual range of *rupestris* is from a complete lack of silvering to a maximum of partial silvering of the submarginal lunules. The Oregon populations are usually silvered, although occasionally the wholly unsilvered or partially silvered forms may occur.

Expanse: 50 to 56 mm., holotype 53 mm. (*rupestris* averages 50 mm.).

Type Material: The holotype male and allotype female are from Butte Falls, Oregon, May 21, 1931 (*ex* J. D. Gunder collection). There are 70 paratypes from Jackson County, southern Oregon, as follows: 6 pairs, Ashland, June (T. B. Blevins, Jr., collection); 2 males, Hyatt Lake, June 29–30 (D. B. Stallings collection); 17 males and 4 females, Butte Falls, May 11–21 (L. P. Grey collection); 3 males and 6 females, Roxy Ann, near Medford, June 30–July 12 (L. P. Grey collection); 4 males, Butte Falls, May 19–23 (C. F. dos Passos collection); 2 pairs, Siskiyou Summit, June 28–29, 1939 (M. Doudoroff, C. F. dos Passos collection); 8 males and 4 females, Butte Falls, May 17–June 24 (*ex* J. D. Gunder collection); 2 females, Medford, May 30–June 6 (*ex* J. D. Gunder collection); 1 male and 1 female, Butte Mountains, July 12–13 (*ex* W. C. Wood collection); 1 female, Siskiyou Pass, June 22 (*ex* J. D. Gunder collection); 1 female, Keene Creek, June 24 (G. Malcolm, *ex* J. D. Gunder collection). All of the specimens were collected by W. F. Lawrence, unless otherwise credited. The holotype, allotype, and the 18 paratypes *ex* J. D. Gunder and *ex* W. C. Wood collections are in the American Museum of Natural History. The other paratypes are in the collections of T. B. Blevins, Jr., D. B. Stallings, as above noted, and the authors.

Remarks: In series, *elaine* is very distinct although the change from *rupestris* is merely to a larger size, deeper color, and greater increase of silvering. Being well distributed in collections, it has given rise to much confusion because of attempts to place it under the older names. This is the insect which Gunder distributed, erroneously, as *hippolyta* (W. H. Edwards) (1879b, p. 81). The northern Coast Range subspecies of *callippe* have been well linked by captures made in recent years. In Mendocino County there is a full transition from *liliana* (Henry Edwards) (1876, p. 170) to *rupestris* in Trinity County. In northern Siskiyou County the species has become like *elaine*, and the aberrant characters of some of the southern Oregon specimens point clearly to the next stage, a transition toward a green phase near *semivirida* (McDunnough) (1924, p. 42), which becomes complete on the dry side of the ranges.

Speyeria callippe sierra, new subspecies

Figures 15, 16

Above, both sexes are dark like *callippe inornata* (W. H. Edwards) (1872, p. 64) but are smaller. The males have the heavy veining, and both sexes have the bold, dark pattern markings characteristic of the California subspecies of *callippe*.

Below, both sexes are well silvered, variable from buff to light brown in the disk, sometimes with a definite overcast of greenish. The band is clear straw varying to light buff.

Expanse: 44 to 53 mm., holotype 45 mm.

Type Material: The holotype male is from Gold Lake, Sierra County, California, July 6, 1928 (C. Hill, *ex* J. D. Gunder collection), and the allotype female is from the same locality, June 27, 1931 (F. W. Friday, *ex* J. D. Gunder collection). There are 28 paratypes as follows: 15 males and 7 females (*ex* J. D. Gunder collection); 5 males and 1 female (L. P. Grey collection), all from Gold Lake, June 23–July 20, and all collected by F. W. Friday. The holotype, allotype, and a series of paratypes are in the American Museum of Natural History. The other paratypes are in the collections of the authors.

Remarks: The correct application of the names *callippe juba* (Boisduval) (1869, p. 60) and *callippe laura* (W. H. Edwards) (1879a, p. 49) is obscure. Lectotype designations, to be given in a subsequent paper, are necessary since both of these insects apparently were described from mixed series, with no indicated holotypes. Unfortunately, no exact type localities can be determined, a matter of utmost importance, because upon both sides of the range Sierran *callippe* is exceedingly plastic, the colonies changing abruptly from valley to valley, with much individual variation and with a long gamut of change to distinct regional types within which the genetic trends of other subspecies appear in aberrant specimens. An arbitrary limitation of *juba* and *laura* would be preferable to the uncertainties with which the names are now applied. The dwarf subspecies *sierra* from the high Sierra, described above, appears to be distinct from the older names.

Collectors who wish to reach the type locality may be interested in the note attached to the Gunder plaque of specimens: "Definite directions. From Gold Lake Camp on road to left around Gold Lake itself, taking road to left at *end* of lake, which is three miles thus far. Thence, continue five miles up over mountain and down in valley to old Willoughby Mine. Specimens taken on hillside almost above Mine. Road is an old one, not passable with auto. F. W. Friday, 1931."

Speyeria callippe harmonia,

new subspecies

Figures 17, 18

Above, both sexes are similar to *callippe meadii* (W. H. Edwards) (1872, p. 67) with heavy black pattern. The borders are not solidly black as they tend to be in the latter subspecies, the marginal lines being fine and clear with brown ground color in the enclosed interspaces between the nervules. There is less basal suffusion than in the average *meadii*, and the ground color is of a lighter shade.

Below, both sexes also are similar to *meadii*. The band of the secondaries is narrowed and sometimes obscured by the olivaceous green ground which is lighter than in *meadii*. The spots are well silvered and often partially edged with black.

Expanse: 55 to 65 mm., holotype 57 mm.

Type Material: The holotype male is from Mount Wheeler (Snake Range near Utah border), Nevada, June 24, 1929 (*ex* J. D. Gunder collection), and the allotype female is from Mount Wheeler, White Pine County, Nevada, June 30, 1929 (F. W. Morand, *ex* J. D. Gunder collection). There are 36 paratypes as follows: 30 males and 6 females, same locality as allotype, June 8–July 5, 1929 (F. W. Morand, *ex* J. D. Gunder collection). The holotype, allotype, and a series of paratypes are in the American Museum of Natural History. The other paratypes are in the collections of the authors.

Remarks: Only after some hesitation have we added another name to those available for the Rocky Mountain-Great Basin green phases of *callippe*. Considered purely upon a population basis the large series of *harmonia* before us (55 males and one female, topotypes, in addition to the type series) displays the least variation we have observed from a given locality. In a color form sense *harmonia* is applicable to the majority of the western Great Basin specimens which we have seen from southeastern Oregon, southern Idaho, northern Nevada, and northern Utah. Topotypical *callippe* *nevadensis* (W. H. Edwards) (1870, p. 14) is from a colony in which the individuals are extreme, being small in size, very pale and in no wise agreeing with the many variations which for years have been lumped under the name. The mountain distribution in Canada, Idaho, Wyoming, and Montana is so variable within single localities that further nomenclature seems unwise at the moment. In Colorado the variation also is great, but *meadii* is in many places a recognizable, if somewhat aberrant, subspecies. The prairie race *callippe calgariana* (McDunnough) (1924, p. 42) is likewise distinctive in the majority of specimens. We believe that *harmonia* has sufficient genetic stability to make the designation useful in describing Nevada and Utah material that is not well placed under the older names.

Speyeria montiviga secreta,
new subspecies

Figures 19, 20

Above, both sexes agree in size and in general appearance with some variations of *atlantis hesperis* (W. H. Edwards) (1864a, p. 502) in northern Colorado, and are separable by attention to details which are significant only if adequate familiarity with the variation is presumed. The lower side silver spots are outlined on the upper surfaces in light tan, contrasting with the reddish tan ground. The feature of spots in lighter relief above is common to many species but is rarely emphasized in Colorado subspecies of *atlantis* (W. H. Edwards) (1862a, p. 54). Since the greatest possibility of confusion here is to *hesperis*, the difference will be found useful. The general color impression in comparison to *hesperis* is of less intensity. The ground color is a lighter shade and not so flushed with red orange.

Below, in both sexes, the primaries differ in that the inner two-thirds are light tan, only slightly touched by the orange red flush seen in *hesperis*. In the secondaries the disk is not the deep (sometimes almost brick-like) red usual in *hesperis*. It is closer to the reddish brown of *montivaga macdunnoughi* (Gunder) (1932, p. 280) although an intensification over the latter subspecies. The band is narrow, often partly obscured, and the spots are well silvered in our series.

Expanse: 50 to 55 mm., holotype 51 mm.

Type Material: The holotype male and the allotype female are from Rocky Mountain National Park, Colorado, 8000 feet, July, 1942, collected by Roy Weist (L. P. Grey collection) in the Estes Park area. There are 4 paratypes as follows: 3 males and 1 female with the same data. The holotype and allotype are in the American Museum of Natural History. The paratypes are in the collections of the authors.

Remarks: The subspeciation of *montivaga* (Behr) (1863, p. 84) has been universally misunderstood. The regional equivalents of *montivaga* are widely distributed, appallingly variable, and they go unrecognized or confounded. Our description of an Idaho subspecies (*linda*, 1942, p. 1) contains a brief note in which this species is first recognized and partly delimited. Since that date we have been accumulating further material and are now satisfied that the variation does go to *montivaga*, which, as the oldest name, will head the species. The insect described here is an important link extending the known range, confirming our postulation that the variants of *montivaga* are generally distributed throughout the western *Speyeria* territories, although we doubt an extension to New Mexico (since elsewhere but little tendency to southern adaptability is shown). The name selected conveys our appreciation of the possibility that *secreta* will be a "hidden" or little known race for many years. It is fully distinct to the expert eye but easily overlooked among specimens of *hesperis*. Students should note the gradual trend of *macdunnoughi* to redness as it comes east, particularly in the Big Horn Mountains of Wyoming where there is some transition to the Colorado subspecies. These colonies are nearly everywhere rare compared to other species of *Speyeria*. Disappointments are to be anticipated when *secreta* is looked for in Colorado among the much more plentiful *hesperis*. These remarks will be extended in a later paper. The space given here is intended to convey our feeling that this group of variants makes up a poorly known entity.

Speyeria hydaspe conquista,
new subspecies

Figures 21, 22

Above, in both sexes, the ground color is the paler shade that we associate with proximity to the Great Basin, but the deep basal suffusion and the heavy pattern convey the impression of a darker insect than *hydaspe sakuntala* (Skinner) (1911, p. 108) and one more nearly like *hydaspe rhodope* (W. H. Edwards) (1874, p. 13), both of which are a brighter, deeper red than *conquista.*

Below, both sexes are nearest to the very dark maroon specimens which usually pass as *rhodope*, but are more sordid in ground color. In the New Mexico specimens the spots are wholly unsilvered, very large, and arrestingly prominent.

EXPANSE: Holotype 56 mm., allotype 58 mm.

TYPE MATERIAL: The holotype male is from Little Tesuque Canyon, near Santa Fe, New Mexico, 8000 feet, August 8, 1932 (A. B. Klots), and the allotype female is from Therma, New Mexico, August 12, 1932 (A. B. Klots). There is one paratype, a female, same locality as holotype, July 8, 1932 (A. B. Klots, C. F. dos Passos collection). The holotype and allotype are in the American Museum of Natural History. The paratype is in the collection of the senior author.

REMARKS: As an entity, *hydaspe* (Boisduval) (1869, p. 60) holds remarkably constant. Throughout a range which nearly covers the western *Speyeria* territories the *hydaspe* subspeciation is closely around a similar type, whereas it is almost a rule in this genus that distant races will vary to nearly unrecognizable extremes. The California variants of *hydaspe* are well known and are satisfactorily classified. The majority of the Oregon specimens are difficult to place under existing names, but the fluctuation in those localities discourages further appellations. Throughout the Rocky Mountains and the Great Basin the name *sakuntala* usually has been employed to designate material from widely separated localities and of varied color forms. In this very loose usage Skinner's name probably is as useful as would be a multiplicity of minor population and form names, since the variation in these regions indicates that consistent applications would be well-nigh impossible. We have ventured to describe the distinctive New Mexico specimens. They are far removed from the British Columbia subspecies and extend published records of the range of *hydaspe.*

Speyeria atlantis lurana, new subspecies

Figures 23, 24

Above, both sexes are like *atlantis hesperis* but are consistently a brighter reddish brown, with black pattern narrowed and reduced, also with less basal suffusion. The affinity is still with *hesperis*, but the change definitely is toward *atlantis lais* (W. H. Edwards) (1883, p. 209).

Below, both sexes are typically unsilvered, with occasional silvered forms. In the disks of the secondaries the ground color varies and is often as dark as in *hesperis* but more usually much lighter. The variants seldom include the suffused and extremely ruddy types encountered in Colorado, and the submarginal band remains free from encroachment.

EXPANSE: 48 to 55 mm., holotype 51 mm. (*hesperis* 50 to 65 mm.).

TYPE MATERIAL: The type series is from the Black Hills of South Dakota. The holotype male and the allotype female are from Harney Peak, June 25, 1939 (A. C. Frederick, *ex* L. P. Grey collection). There are 32 paratypes as follows: 10 males and 5 females, same data as holotype; 10 males, Spearfish Canyon, near Lead, July 1, 1939 (A. C. Frederick, L. P. Grey collection); 5 males and 2 females, Custer, 1928 (C. F. dos Passos collection). The holotype, allotype, and a series of paratypes are in the American Museum of Natural History. The other paratypes are in the collections of the authors.

REMARKS: The Black Hills are isolated from the main Rocky Mountain groups by intervening "Bad Lands," and minor subspecies of many butterflies are recognizably characteristic of the region. In comparison to topotypical *hesperis* from the Front Range of Colorado, these Black Hills specimens are quite distinct and, as populations go in the western clines of this species, are remarkably constant. The slightly smaller size, redder and clearer ground, with reduction of pattern intensity above and below, are regionally typical. This subspecies is not the best indication of transition to *lais*, the main relationship being to *hesperis*. The transformation to *lais* is ideally shown in northern Montana but in colonies that vary so widely that subspecific names for them would seem to be pointless.

Speyeria atlantis wasatchia,
new subspecies
Figures 25, 26

Above, in both sexes, the ground color is not ruddy but is a clear light buff similar to *atlantis chitone* (W. H. Edwards) (1879b, p. 82) and intermediate to the slightly darker new subspecies *tetonia*, which we describe next. The pattern is not heavy but is sharp and clear. The basal suffusion is not extensive.

Below, both sexes verge more in appearance toward *tetonia* and *atlantis irene* (Boisduval) (1869, p. 60) than toward *atlantis nikias* (Ehrmann) (1917, p. 55) and *hesperis*, as is to be seen in the dull disk with typically unsilvered rectangular spots and in the somewhat narrowed submarginal band of the secondaries.

Expanse: 50 to 57 mm., holotype 53 mm.

Type Material: The holotype male and the allotype female are from Payson Canyon, Payson, Utah, July 16, 1932 (L. D. Pfouts, *ex* J. D. Gunder collection). There are 44 paratypes as follows: 8 pairs, same locality and collector, July 15-28 (*ex* J. D. Gunder collection); 13 males and 7 females, July 3-29, same locality and collector (L. P. Grey collection); 4 pairs, same locality, July 9-20 (T. Spalding, C. F. dos Passos collection). The holotype, allotype, and a series of paratypes are in the American Museum of Natural History. The other paratypes are in the collections of the authors.

Remarks: The name *chitone* applies in a loose way to the "washed out" southern Great Basin specimens of the *atlantis* stock. These are in marked contrast to the ruddy, heavily patterned populations found along the main Rocky Mountain chain, although subspecies are hardly clean-cut anywhere. There is great variation within the Great Basin colonies, but they split rather well into two groups: the southern (*chitone*) in which the specimens are well silvered or obscurely so, resembling a paler version of the ruddy *nikias* of New Mexico; and the more northern part of the cline in which there is transition ,to the colonies which skirt the western slopes of the continental divide and culminate in *irene* of the Sierras. The three names herein proposed by us, i.e., *wasatchia* and the two following, represent distinct regional variations along this extended northwestern dispersal path.

Speyeria atlantis tetonia, new subspecies
Figures 27, 28

Above, both sexes are like *hesperis* but are not so ruddy, being lighter in basal suffusion, band area, and submarginal lunules. The pattern tends to be finer.

Below, both sexes incline to lack of silvering in the spots but have complete intergradation to silvered forms. Typically, the subspecies is wholly unsilvered or obscurely so. The band area is restricted, often almost or quite obscured. In *hesperis* the band is nearly always prominent and wholly clear. The disk is lighter brick red than in *hesperis*. In the mountain states the *atlantis* populations are not genetically homogeneous. They are difficult to characterize and describe minutely because so many individual specimens will fail to agree with any rigid formula. The average specimen of *tetonia* is one which is varying away from the fluctuating *hesperis* of the Front Range and is beginning to resemble *irene*.

Expanse: 50 to 60 mm., holotype 53 mm.

Type Material: The type series is from the Teton Mountain region, Wyoming. The holotype male is from the Teton Mountains, July 11, 1931 (*ex* J. D. Gunder collection), and the allotype female is from the same locality, June 25, 1931 (*ex* J. D. Gunder collection). There are 38 paratypes as follows: 1 pair, same locality as holotype, June 29–July 18: 2 males and 3 females, Moose Post Office, Jackson Hole, July 9–August 3 (A. B. Klots, the American Museum of Natural History); 1 male, Jackson, 6600 feet, July 13–17, 1920 (the American Museum of Natural History); 2 males and 4 females, Moose Post Office, Jackson Hole, 6600 to 7000 feet, July 15–August 3, 1929 (A. B. Klots, C. F. dos Passos collection); 8 males, Teton Mountains, July 1–21, 1943, and 8 pairs, Jackson Hole, July 14–August 9, 1937 (L. P. Grey collection).

REMARKS: This is one of the names through which we indicate a hitherto undefined spur of *atlantis*. From Wyoming, along the upper limits of the Great Basin, west of the continental divide, the trend is away from the variation commonly referred to *hesperis* or to *atlantis beani* (Barnes and Benjamin) (1926, p. 92) and is toward the color form which becomes *irene* in the Sierras. With the addition of a Sierran cline, *atlantis* is by all means the most widespread of the entities in this genus.

Speyeria atlantis viola, new subspecies

Figures 29, 30

Above, both sexes are similar to *irene* but are somewhat paler. The latter insect is reddish brown, and the new subspecies is of a lighter shade and not so ruddy.

Below, both sexes are instantly recognizable as being close to *irene*, but they are somewhat paler in the disk and vary toward some of the northern Great Basin unnamed intermediates to *tetonia*, occasionally with tinges of the ruddiness of *hesperis*. The spots are rarely well silvered and usually are not silvered at all.

EXPANSE: 48 to 53 mm., holotype 49 mm.

TYPE MATERIAL: The type series is from the Sawtooth Mountains, Idaho. The holotype male is from Trail Creek, 7400 feet, July 11, 1931, and the allotype female is from Camp Creek, August 9, 1931 (C. W. Herr, *ex* J. D. Gunder collection). There are 23 paratypes as follows: 2 males, same data as holotype; 5 males and 1 female, Camp Creek, July 9; 2 males and 3 females, Deadwood Creek off Payette River, Boise County, 6800 feet, July 18; 2 females, Deadwood Summit, July 18; 1 male, Park Canyon, 7650 feet, July 10; 1 male, Wood River, July 17; 1 male, Summit Creek, 7800 feet, July 13; 1 male, Kane Creek, 8500 feet, July 8 (all preceding, *ex* J. D. Gunder collection); 3 males and 1 female, Custer County, July 18–21, 1933 (L. P. Grey collection). The holotype, allotype, and a series of paratypes are in the American Museum of Natural History. The other paratypes are in the collections of the authors.

REMARKS: It has been considered advisable to name certain colonies of the *atlantis* subspeciation between *hesperis* and *irene* in order to call attention to the relationship. The present colony was selected because here there can be no misunderstanding. These Idaho representatives are indubitably near relatives of *irene*. Granted this, the variation from the Teton region through Targhee, Salmon, Challis, Payette, and Sawtooth National Forests impresses us by reason of the outcropping of "forms" and interchange of genetic tendencies seen in almost any random colony. Even in the subspecies *tetonia* and occasionally as far away as the Wasatch Mountains of Utah, certain specimens tend to be close to *irene*, while in all of the colonies the *hesperis* aspect is recurrent. From extensive material our conclusion is that the polytypic species of *Speyeria* will remain incomprehensible until the species units like *atlantis* are given due recognition, which means less insistence upon the specific merits of localized color forms. The intergradation between these colonies is continuous. The subspecific names are of real usefulness only to the extent that they summarize regional trends and help toward an understanding of the larger entities.

NOTE: Since we contemplate further work in *Speyeria*, we are not distributing paratypes at present. Later, we shall deposit paratypes where they will be available to West Coast, Canadian, and European students in the instances where extent of material permits depletion. All short series will be turned over intact to the American Museum of Natural History. The size and importance of the *Speyeria* collection make this institution uniquely suitable as a repository and center of study for these butterflies.

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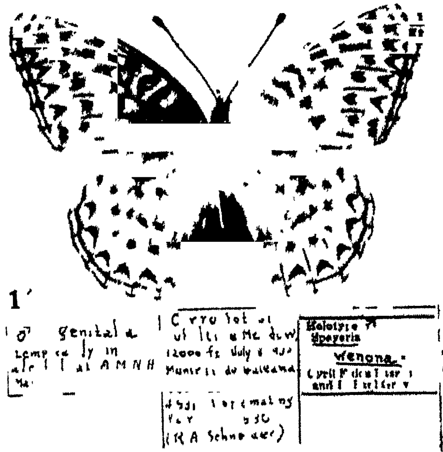
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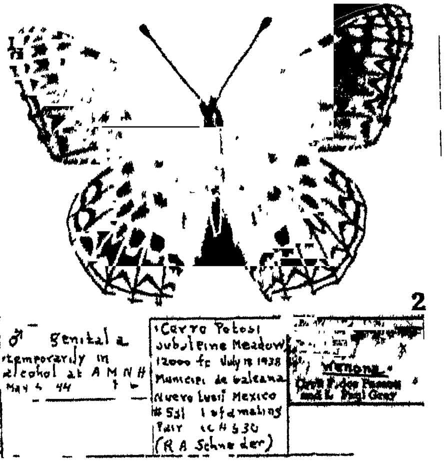
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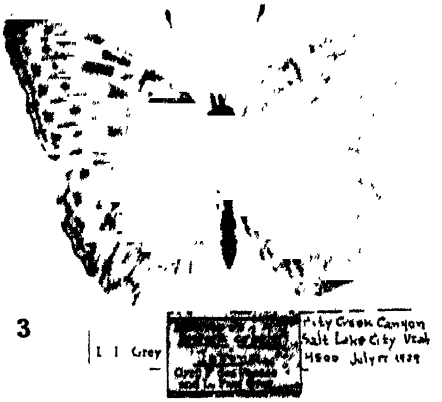

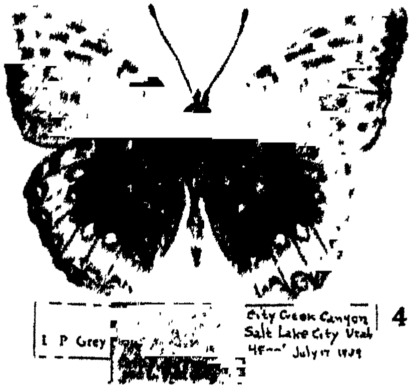

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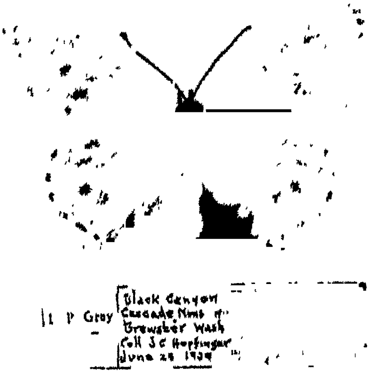
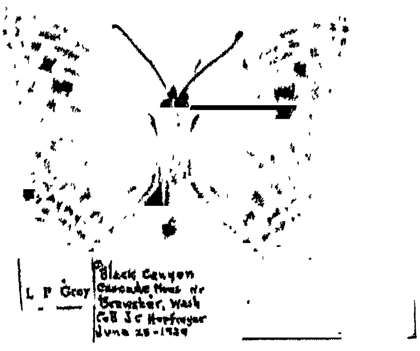
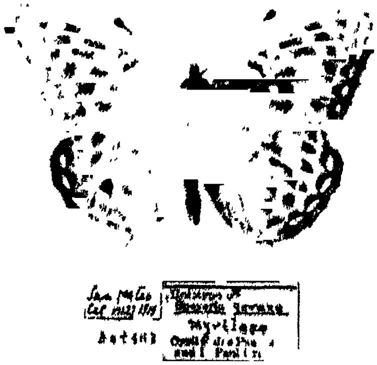




Figs 1–2 *Speyeria wenona* dos Passos and Grey, holotype male, upper and under surfaces.
Figs. 3–4 *Speyeria cybele letona* dos Passos and Grey, holotype male, upper and under surfaces.
Figs 5–6. *Speyeria coronis simaetha* dos Passos and Grey, holotype male, upper and under surfaces.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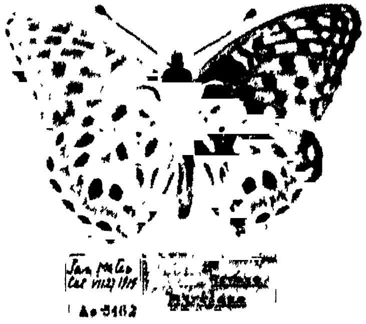
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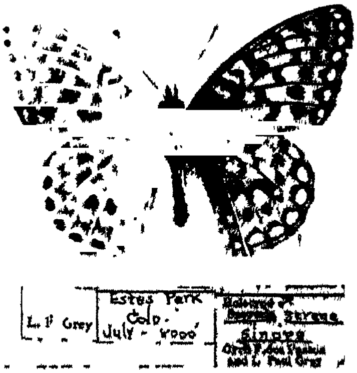

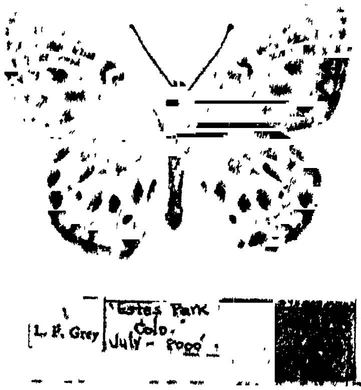

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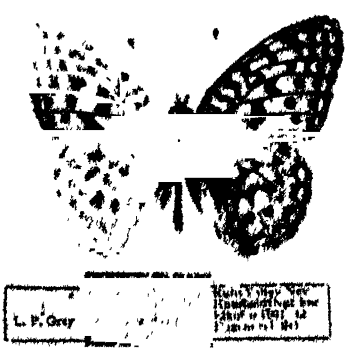

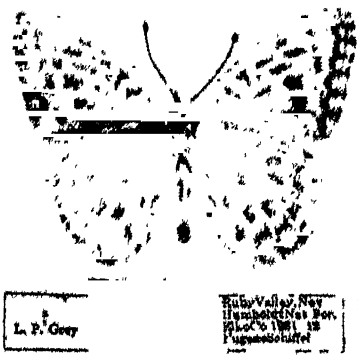

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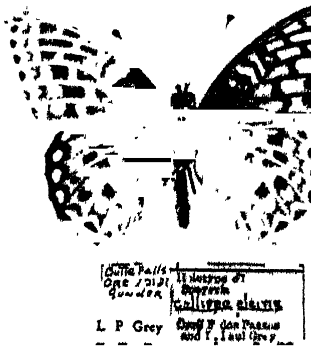
Figs. 7–8. *Speyeria zerene myrtleae* dos Passos and Grey, holotype male, upper and undei surfaces.
Figs. 9–10 *Speryeria zerene sinope* dos Passos and Grey, holotype male, upper and under surfaces.
Figs. 11–12. *Speyeria zerene cynna* dos Passos and Grey, holotype male, upper and undor surfaces.



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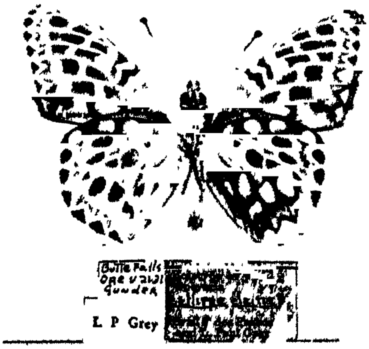

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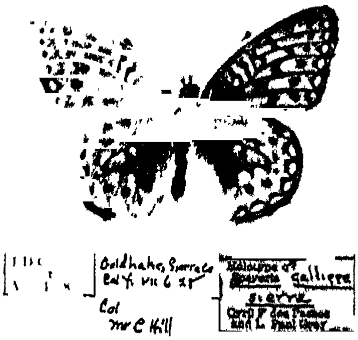

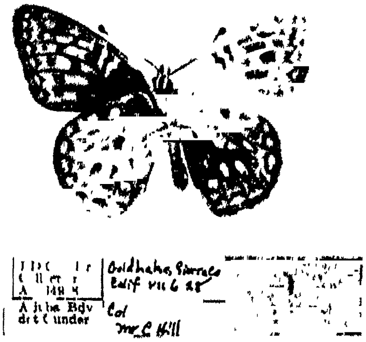

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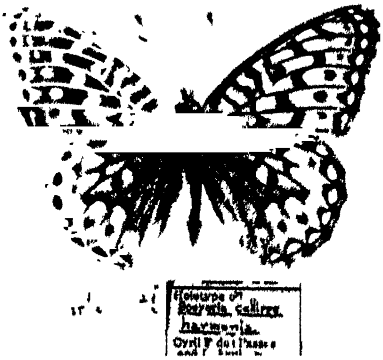

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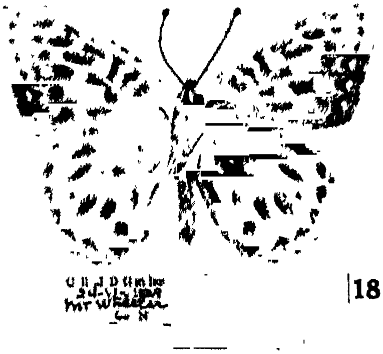

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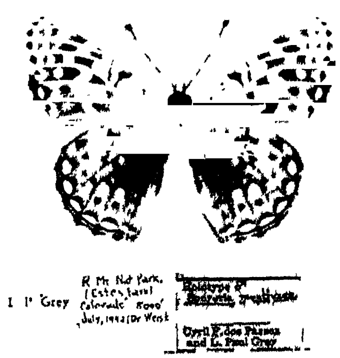
Figs 13–14 *Speyeria callippe elaine* dos Passos and Grey, holotype male, upper and under surfaces

Figs 15–16 *Speyeria callippe sierra* dos Passos and Grey, holotype male, upper and under surfaces

Figs 17–18 *Speyeria callippe harmonia* dos Passos and Grey, holotype male, upper and under surfaces



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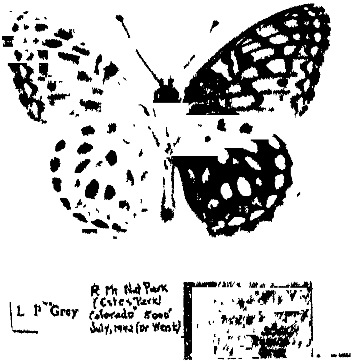

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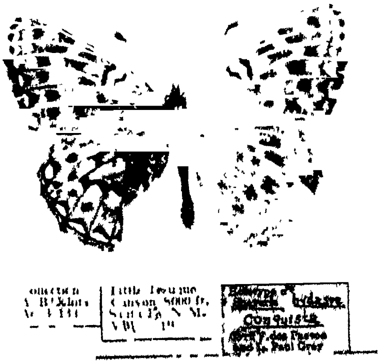

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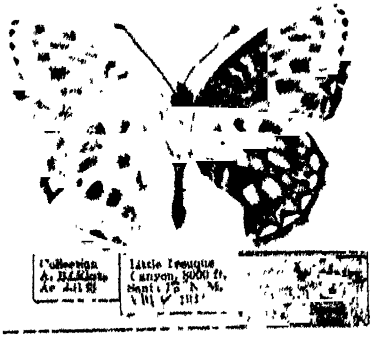

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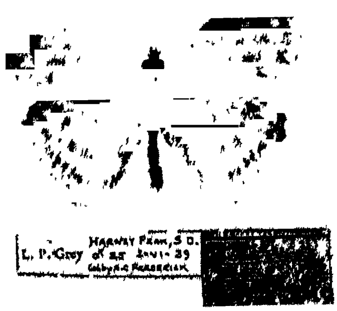

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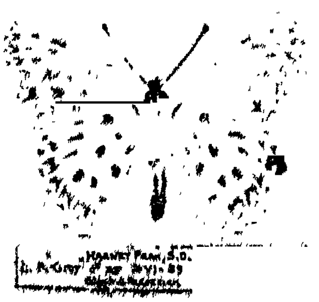

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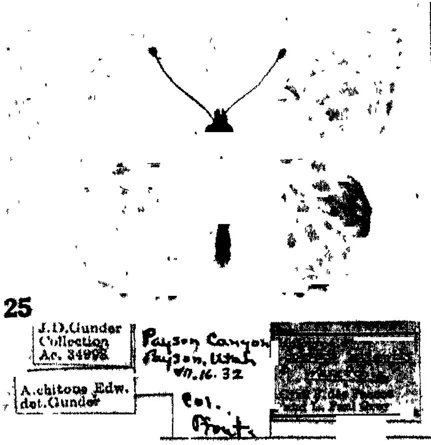
Figs. 19–20. *Speyeria montivaga secreta* dos Passos and Grey, holotype male, upper and under surfaces.

Figs. 21–22. *Speyeria hydaspe conquista* dos Passos and Grey, holotype male, upper and under surfaces.

Figs. 23–24. *Speyeria atlantis lurana* dos Passos and Grey, holotype male, upper and under surfaces.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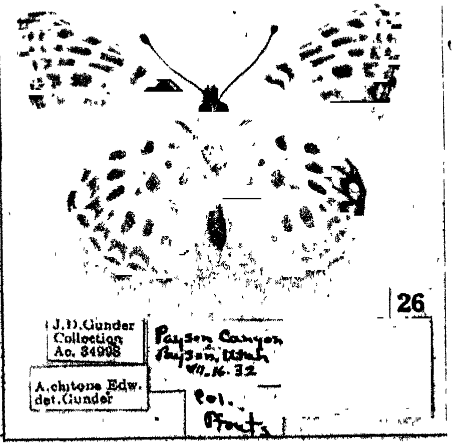
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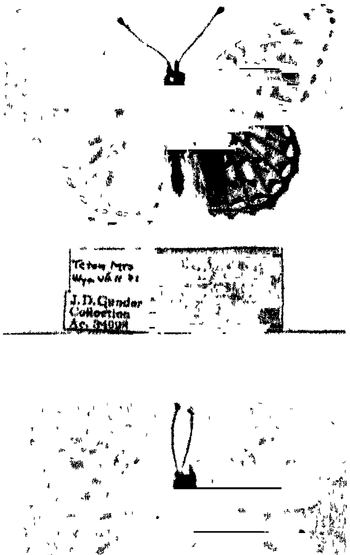
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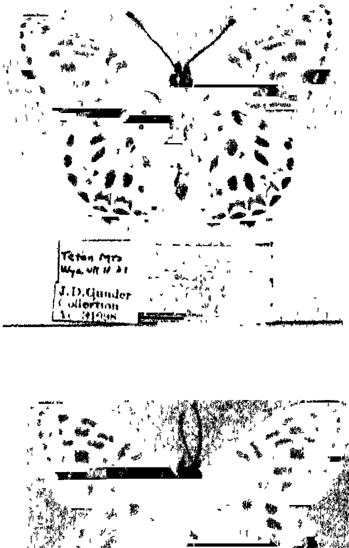
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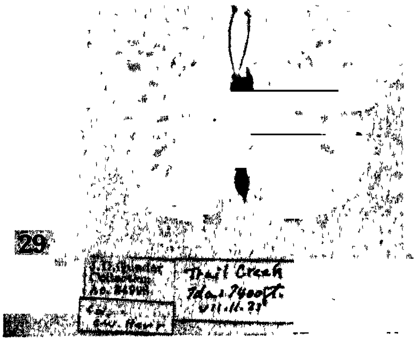
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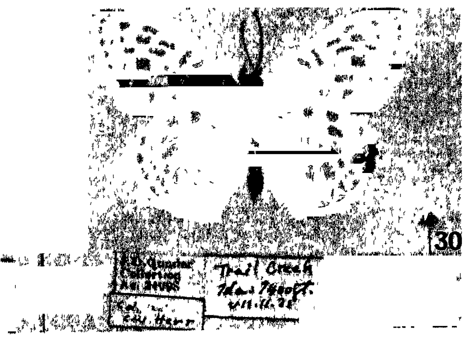
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Figs. 25–26. *Speyeria atlantis wasatchia* dos Passos and Grey, holotype male, upper and under surfaces.

Figs. 27–28. *Speyeria atlantis tetonia* dos Passos and Grey, holotype male, upper and under surfaces.

Figs. 29–30. *Speyeria atlantis viola* dos Passos and Grey, holotype male, upper and under surfaces

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SCORPIONS OF THE GENUS *HADRURUS* THORELL

BY HERBERT L. STAHNKE[1]

HADRURUS THORELL

Hadrurus THORELL, 1876, Ann. Mag. Nat. Hist., ser. 4, vol. 17, p. 11; KRAEPELIN, 1899, Das Tierreich, Scorpiones und Pedipalpi, no. 8, p. 187; POCOCK, 1902, Biologia Centrali-Americana, Scorpiones, Pedipalpi, Solfugae, p. 5; EWING, 1928, Proc. U. S. Natl. Mus., vol. 73, p. 7; HOFFMAN, 1931, An. Inst. Biol. Mexico, vol. 2, p. 334; WERNER, 1934, *in* Bronn, Klassen und Ordnungen des Tierreichs, vol. 5, book 8, Pedipalpi, Scorpiones, p. 265.

The scorpions of this genus are popularly called the giant hairy scorpions. This is because of the large, noticeable bristles rather thickly covering the pedipalps, legs, and distal segments of the cauda including the vesicle of the telson. The movable finger of the chelicera is armed on its inferior border with a single large, sharp, darkly pigmented tooth. The ocular tubercle is approximately in the middle of the carapace. Four species are now recognized in the genus. Their venom is not of a lethal nature, even when relatively large quantities are injected in white rats of only 50–60 grams. In general, laboratory and clinical experiences indicate that the venom apparently produces only a local reaction consisting of a badly swollen area around the site of the injection which may become greatly discolored. The swelling may persist for about 5 to 24 hours and is quite painful at first.

CARAPACE: Color dependent on species. Six lateral and two median eyes. The lateral eyes are not arranged in a straight row. Posterior and dorsal to the two anterior eyes of each set of three is a raised portion, the lateral superciliary ridges. Median ocular tubercle quite prominent, with fairly well-developed median superciliary ridges. The ocular tubercle is only slightly anterior to the midpoint of the carapace. Keels poorly developed. Anterior median furrow distinct, while posterior median furrow ends posteriorly as a deep, narrow pit. A broad furrow leads laterally from each ocular tubercle, making the figure of a cross with the median furrows. Posterior to this is another transverse furrow which is deep laterally but quite shallow and indefinite where it crosses the posterior median furrow. Coarsely granulated in general. Usually the interocular triangle very sparsely covered on female but densely covered with medium-sized granules on male.

DORSAL PREABDOMEN: Color dependent on species. No keels present on first six segments. Median and lateral keels only poorly developed on seventh segment. Terga generally well covered with small to large granules, but frequently the posterior and lateral margins bear the largest ones. The seventh segment is more densely granulated and bears much larger granules. Sexual differences are noticeable in granule size, but the variation in one sex is great enough to obliterate the value of this factor in sex determination.

VENTRAL PREABDOMEN: Color dependent on species. Bristles sparsely scattered over posterior and lateral margins and plane surfaces of the abdominal plates. The third, fourth, fifth, and sixth segments of the female bear a few large granules on the posterior lateral margins of the abdominal plates. On the male these segments are well covered with granules laterally except the sixth, which is quite densely covered. On both sexes these plates are quite smooth except for the extreme posterior edges. The seventh segment has a few large granules in the intercarinal spaces. The median keels of the seventh segment are very poorly developed, while the lateral keels consist of a few large granules. Stigma elongate. Sternum subpentagonal, about twice as broad as long, with a deep, T-shaped, median, pit-like furrow. One large bristle and two or three smaller ones on each half. Genital operculum divided medially in both sexes. Genital papilla not present on male. Four to six large bristles on the posterior portion of each lateral half. The basal piece of the pectines broader than long with a deep, narrow, median furrow extending posteriorly about one-third the length, well covered with large bristles. Three elongate anterior lamellae, quite well covered with bristles. About 16 middle lamellae, but number is variable. Subcircular except first, which is large and somewhat triangular. Each lamellae bears two to three large bristles. Fulcra subtriangular and each bearing as many as five bristles. Teeth, 25–40, more numerous and longer on male than on female, very noticeably so on *spadix* and *arizonensis*. On the female the distance from the medial point of attachment of the pectines to the base of the first tooth is much greater than the widest portion across both anterior and middle lamellae. On the male this distance is about the same or less than the combined width of the two lamellae. This sexual difference can be detected with the naked eye and is even present on very young specimens. It is the only reliable and distinct external characteristic for the sexual differentiation of *H. hirsutus*.

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CAUDA: Color light to straw yellow with black aculeus. Granules of keels vary from slightly darker yellow to red in color. Segments 1 and 2 lightly bristled but segments 4 and 5 and ampulla densely bristled. Nearly all keels granular and well developed. Inferior median keels all well developed; smooth on segments 1 and 2; granulated on distal end of segment 3; entirely granulated on segment 4; and strongly denticulate on segment 5. Inferior lateral keels well developed; smooth on segment 1; granulated at extreme distal end on segments 2 and 3; somewhat denticulate on segment 4; and strongly denticulate on segment 5. Median lateral keel incomplete on all segments except the first, where it is distinctly granulated; marked by moderately large granules on distal half of segments 2 to 4; and by large granules on proximal half of segment 5. Superior lateral keels poorly developed but well marked by prominent granules. Dorsal keels are poorly developed but well marked by moderate-sized granules on the first to fourth; lacking on the fifth. Intercarinal spaces on superior surface of first segment well covered with moderately large granules. Heavy granules also found on ventral and lateral faces of segment 5. Other segments smooth except the dorsolateral areas of segments 2 to 4, which are lightly studded. Telson well covered with long bristles; ampulla subglobate. Ventral surface moderately studded with low, broad granules except at the base where a few large, denticulate, red granules are located. The aculeus is black at the distal half to two-thirds, and the venom orifices are a very short distance from the tip in a dorsolateral position. These apertures are of a somewhat tear-drop shape with the globate portion directed proximad, and receive the venom duct. No subacular tooth or tubercle.

APPENDAGES: Legs light to straw yellow color with lateral red spots at joints between tarsus and protarsus, between metatarsus and tibia, and between tibia and femur. All legs well supplied with large reddish bristles. Femurs of first pair of legs one-half as long as those of fourth pair; those of legs 1 to 4 have on their inferior face a double longitudinal series of dentiform granulations, which are more distinct on legs 2 and 3 and incomplete and weak on 1 and 4. *H. aztecus* and *H. spadix* show a greater development of these granule rows. Claws, unguicular spines, and pedal spurs well developed. Pedal spurs bear denticulate spines. The unguicular lobe is well developed, but no tarsal spurs are present. The tarsi and protarsi bear rows of spines. Fingers of pedipalps basically light to straw color; tipped with red in some species. The cutting edge of the movable finger bears nine oblique rows of denticulate granules; the most proximal granule of all but the first row is much larger. The fixed finger bears only seven of these large proximal granules. Flanking these oblique rows on their inner side is a row of nine large, widely spaced dentiform granules on the movable finger but there are only seven on the fixed digit. Each finger bears on its extreme distal point a large, somewhat curved dentiform granule. Hands of the pedipalps moderately bristled. Except for a few smooth patches, the superior surface is covered with small granules interspersed with larger ones. The superior digital keel is poorly developed except on the finger. The inner superior keel is more pronounced and covered with large granules at its proximal end, as is also the inner marginal keel. The exterior marginal keel is densely granulated with large, rounded granules. The inner edges of the superior and inferior surfaces of the brachium are sharp and bear large, more or less rounded, reddish granules. The outer edges are rounded and bear light-colored, rather large, rounded granules over part of their length. The smooth inner surface bears a few large granules but is densely covered with long, stout bristles. The smooth outer surface bears a smooth, poorly developed keel and is moderately covered with long slender bristles. A few weak bristles appear on the inferior surface. On the superior surface are found eight to 10 trichobothria and a dense covering of small granules interspersed by large ones. The inner edge of the superior and inferior surfaces of the humerus bears a row of large, reddish, rounded granules, but the outer edge of the superior surface bears large rounded granules having the same color as the rest of the humerus. An inferior outer edge is lacking. The inner and outer surfaces are moderately covered with large bristles while the superior and inferior surfaces are only lightly covered. The inferior surface is smooth except for a light covering of different sized granules on the proximal half. The superior surface is densely covered with small granules. The inner surface is lightly covered with small granules, among which are dispersed a few large ones. Covering the proximal one-fourth of this surface is a poorly developed median keel bearing a few large granules. The outer surface is smooth. The inferior, inner border of the movable finger of the chelicera bears a large, black-tipped tooth and a row of bristles extending nearly the proximal half of its length.

Habits, Habitats, and Food: The members of this genus are burrowing scorpions. They frequently dig down 2 and 3 feet in sandy washes and river banks. Here they remain, even though the burrow has collapsed, apparently finding no difficulty in breathing. A well-fed *Hadrurus* may remain thus buried for four and five months. In experiments, well-fed specimens have been kept in an empty, open fruit jar for nine months without food and water. Specimens taken in the field are generally found under boards, sacks of grain, and rocks; or any place that affords them a cool, dark shelter after a night of prowling. One specimen brought in was found under a large watermelon in the field. Frequently men hauling sand from a wash or river bed will dig them out. These scorpions readily eat roaches, crickets, and spiders. Although they do not eat sow bugs or harvestmen, a hungry specimen will frequently grab one of these, only to reject it. When hungry they will eat hard beetles, such as June beetles, or, as observed in this laboratory and also reported afield, they will eat the softer lizards.

Remarks: The carapace length of some specimens, especially in *H. spadix,* is greater because of an elongation or projection of the anterior median border. Anomalies are also found in pectine teeth. Frequently double-tipped teeth will be found. These are always counted as two since it is clear that separation merely failed to take place. The frequent presence of small pectine teeth indicates a regenerative ability on the part of this genus. Specimens preserved in denatured alcohol and those that have dried before having been placed in preserving fluid tend to lose the yellow and dark pigments, thus making them difficult to classify.

Key to the Species of *Hadrurus*

1. Anterior portion of interocular triangle light yellow or straw color........2

Anterior portion of interocular triangle of a dark brownish to black color...............*spadix* Stahnke

2. A crescentic, darkly pigmented region passing through the ocular tubercle with the horns of the crescent touching the lateral eyes (faint or absent in poorly preserved specimens). The remainder of the carapace of a straw or greenish yellow color.............................*hirsutus* (Wood)

Crescentic region indefinite or lacking and region posterior to it of a very dark color......................3

3. The fingers and hand of pedipalp of one color or the fingers of a slightly darker color.....*arizonensis* (Ewing)

The fingers of the pedipalps definitely of a darker color than the hand...............*aztecus* Pocock

TABLE 1

HADRURUS SPADIX

A.S.C. Spec. No.	Length Carapace	Length Telson	Abdomen Length Pre-	Abdomen Length Post-	Total Length	Pectine Teeth R/L	Movable Finger Length
			Males				
17	10.3	10.2	20.4	39.9	80.8	39/39	10.7
1	11.0	11.2	20.6	43.0	85.8	40/39	11.7
8	11.1	11.5	25.6	48.0	96.2	39/38	13.3
475	11.6	11.5	20.2	48 4	91.7	38/39	13.0
16B	11.8	11.4	31.0	50.2	104.4	37/38	13 3
16A	11.8	11.6	29.5	50.0	102.9	35/35	13.2
15B	11.8	12.1	21.4	51.0	96.3	38/38	13.4
2	12.1	11.6	23.3	52.1	99.1	35/37	14.0
			Females				
333.25	10.1	10.0	20.1	37.0	77.2	30/29	10.6
434	10.3	10.0	16.0	36.4	72.7	29/32	10.5
476	11.0	10.3	24.9	40.1	86.3	26/28	11.6
354.0	12.4	12.1	31 2	46.6	102.3	30/30	12.5
3	12.4	12.8	27.4	49.0	101.6	29/30	13.3
15A	12.5	12.2	35.6	47.5	107.8	31/32	13.1
348.1	12.7	12.8	25.8	50.7	102.0	33/31	13.5
7	13.2	12.8	32.8	49.0	107.8	30/30	13.5

Hadrurus spadix Stahnke

Hadrurus spadix Stahnke, 1940, Iowa State College Jour. Sci., vol. 15, p. 102.

The outstanding difference in the appearance of this species and the others of the genus is its lack of any yellow coloration within the region of the interocular triangle and the almost uniform date-brown color of the entire carapace and trunk. A few specimens examined had a few indefinitely shaped and distributed yellow spots on the carapace. Whether this was a natural variation or caused by the preserving fluid is not known. These spots were never observed in living specimens. The light yellow color of the appendages stands out in sharp contrast to the dark trunk except for the reddish color of the pedipalp fingers.

Carapace: Color blackish to date brown, even the extreme lateral margins. Some preserved specimens displayed one or two yellow patches which seem to be due to the preservative. Median eyes closer together than in *hirsutus* and *arizonensis*. Granules generally larger and more abundant than on other species.

Dorsal Preabdomen: Entire surface of sclerites dark brown. Granules generally larger and more abundant than on other species.

Ventral Preabdomen: Color dusky brown intermingled with tan. Teeth considerably longer on male than on female. On the female the most proximal part of the middle lamellae as wide or wider than the length of the teeth; on the male this region much smaller than the length of the teeth. Teeth: female, 26–33; male, 35–40.

Cauda: Yellow to tan with black aculeus. Keels have reddish granules especially noticeable on segments 4 and 5, but only slightly so on segments 1 and 2. In general the cauda more slender than those of *hirsutus* and *arizonensis*.

Appendages: Legs light yellow, strongly contrasting with dark trunk. Granule rows well developed on inferior face of femurs of legs 2 and 3; weaker on legs 1 and 4. Fingers of pedipalps red. This color sometimes fades from preserved specimens. The redness extends proximally along inner marginal and inner superior keels, sometimes to such an extent as to give the superior surface of the entire chela a distinctly reddish appearance. The movable finger definitely longer than the carapace on males; may be as long or longer on females.

Locality Records: 1 ♂, no. 1, Cedar Ridge, Grand Canyon, Arizona (D. E. Fuller), G.C.M.[1]; 1 ♂, 1 ♀, nos. 2 and 3, Phantom Ranch, Grand Canyon, Arizona (E. D. McKee), G.C.M.; 1 ♀, no. 7, Grand Canyon Village, Arizona (E. D. McKee), G.C.M.; 1 ♂, no. 8, Hermit Basin, Grand Canyon, Arizona (F. Richardson), G.C.M.; 1 ♀, 1 ♂, nos. 15A and 15B, Wupatki National Monument, Flagstaff, Arizona (unknown), M.N.A.; 2 ♂, nos. 16A and 16B, Wupatki National Monument, Flagstaff, Arizona (unknown), M.N.A.; 1 ♂, 4 ♀, nos. 17, 333.25, 354, 434, 476, Wupatki National Monument, Flagstaff, Arizona (D. J. Jones), A.S.C.; 1 ♀, no. 348.1, Hurricane, Utah (W. J. Gertsch), A.M.N.H.; 1 ♂, no. 175, Wupatki National Monument, Flagstaff, Arizona (Phil Van Cleave), A.S.C.

Hadrurus hirsutus (Wood)

Buthus hirsutus Wood, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 108; Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 5, p. 367.

Buthus emarginaticeps Wood, 1863, Proc. Acad. Nat. Sci. Philadelphia, p. 109; 1863, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 5, p. 367.

Hadrurus hirsutus Thorell, 1876, Ann. Mag. Nat. Hist., ser. 4, vol. 17, p. 11; Kraepelin, 1899, Das Tierreich, Scorpiones, Pedipalpi, no. 8, p. 188; Pocock, 1902, Biologia Centrali-Americana, Scorpiones, Pedipalpi, Solfugae, p. 6; Ewing, 1928, Proc. U. S. Natl. Mus., vol. 73, p. 8; Hoffman, 1931, An. Inst. Biol. Mexico, vol. 2, pp. 335–340.

An outstanding characteristic of this species is the dark, more or less crescent-shaped spot passing through the ocular tubercle with the tips of the crescent horns reaching the lateral eyes. The rest of the body, except the aculeus and a few other very inconspicuous spots, light yellow. Sometimes the dark crescent is obliterated in preserved specimens and also apparently becomes less distinct with age. These characteristics are present in very young specimens which quite occasionally may also have faint, irregular, dark spots on both carapace and dorsal surface of the preabdomen. The posterior carapace and preabdomen of live specimens have a greenish hue due to the partially visible body contents.

Carapace: A blackish, crescent-shaped area passes through the ocular tubercle with the tips of the crescent horns reaching the lateral eyes. Preserved specimens frequently show the spot only faintly or not at all. This spot generally most distinct in the young. The rest of the carapace light yellow. In males the area posterior to the crescent somewhat darker yellow. In live specimens this posterior area may be a greenish hue.

Dorsal Preabdomen: The entire dorsum light to straw yellow in preserved specimens. Occasionally a very young specimen may have a few diffuse dark brown spots.

Ventral Preabdomen: Preserved specimens do not show contrast between book lungs and rest of ventral plates. Entire ventral surface yellow to light brown. Live specimens have more of a greenish hue on ventral plates but book lungs are whitish yellow. Difference between tooth length of male and female not so noticeable in *hirsutus*. The most reliable sexual characteristic is the difference in length of median free border of most proximal middle lamella, that of the female being definitely longer than that of the male.

Cauda: Entire cauda light to straw yellow except for black-tipped aculeus. Granules on segments 4 and 5 not so

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[1] Abbreviations indicate repositories of specimens. G.C.M., Grand Canyon Museum; M.N.A., Museum of Northern Arizona, Flagstaff, Arizona; A.S.C., Arizona State College, Tempe, Arizona; A.M.N.H., American Museum of Natural History, New York.

TABLE 2

HADRURUS HIRSUTUS

A.S.C. Spec. No.	Length Carapace	Length Telson	Abdomen Length Pre-	Abdomen Length Post-	Total Length	Pectine Teeth R/L	Movable Finger Length
			Males				
340.3	7.4	6.7	12.5	25.7	52.3	35/34	7.5
340.4	10.1	10.3	16.2	38.6	75.2	35/34	11.3
339.3	10.3	9.5	23.2	37.6	80.6	36/36	10.6
339.5	13.6	13.6	28.3	53.2	108.7	37/39	15.0
			Females				
340.2	5.3	4.7	13.9	17.2	41.1	32/32	5.7
513 (alive)	9.8	9.1	20.1	35.8	74.8	27/28	10.2
339.4	11.3	11.0	20.2	41.6	84.1	30/30	11.7
202	11.9	11.0	30.3	44.2	97.4	27/27	12.8
340.1	12.0	11.2	24.6	42.7	90.5	30/30	11.8
340.5	12.6	12.4	25.4	46.0	96.4	29/28	13.2
339.1	12.7	11.9	23.4	45.3	93.3	31/31	13.2
339.2	13.8	14.9	26.2	50.6	105.5	30/30	14.2
204	14.0	13.3	29.1	50.3	106.7	28/30	14.0
203	14.3	13.8	34.6	51.5	114.2	?/28	14.7
21	15.5	15.0	38.2	59.0	127.7	30/31	17.1

noticeable, because of their light color, as on the other species. Vesicle usually as broad as, or narrower than, segment 5.

APPENDAGES: Legs light yellow in color. Granule rows weakly developed on inferior surface of leg femurs. Pedipalps light yellow in color except for a faint reddish tinge on the fingers. Even granules have only a slightly darker color so that they are not nearly so noticeable as on the other species. Movable finger generally longer than carapace on both male and female.

LOCALITY RECORDS: 1 ♀, no. 21, Yuma, Arizona (I. R. Nielson), A.S.C.; 1 ♀, no. 202, Olgibly, California (L. Hedgpeth), A.S.C.; 2 ♀, nos. 203 and 204, Yuma, Arizona (M. Ayers), A.S.C.; 3 ♀, 2 ♂, nos. 339.1-339.5 Cathedral City, California (unknown), A.M. N.H.; 3 ♀, 2 ♂, nos. 340.1–340.5, Indian Wells, California (C. M. Bogert), A.M.N.H.; 1 ♀, no. 513, Brawley, California (B. J. Juvenal), A.S.C.

Hadrurus arizonensis (Ewing)

Hadrurus hirsutus arizonensis EWING, 1928, Proc. U. S. Natl. Mus., vol. 73, p. 9.

This species differs characteristically from *H. hirsutus* in that it lacks a distinct interocular crescent. The horns of the crescent are present but the body is continuous with the date-brown coloring of the posterior part of the carapace. The dorsal surface of the trunk is a date brown intermingled with gray and yellow. Freshly preserved specimens are of a date brown interspersed with yellow. Some of the living specimens when distended with food appear olive green banded with date brown and gray. This change in appearance is due to the now visible intersegmentary and lateral membranes. Some specimens appear more gray than date brown. Examination under the microscope shows this to be caused by a dusty deposit between the granules of the terga. When specimens are washed this material comes off and the animal appears a deep reddish to blackish brown. Some specimens have a heavier deposit of the dark pigment than others. This characteristic pattern first appears when the scorpion is three weeks old. At first its basic color is tan, but this gradually changes to date brown.

CARAPACE: The lateral margins and the anterior two-thirds of the interocular triangle pale yellow; the rest of the carapace date brown; median ocular tubercle black. Dark pigment generally extends to lateral eyes in the shape of the inwardly curving horns of a crescent. The body of the crescent lost by a posterior invasion of the dark pigment.

TABLE 3

HADRURUS ARIZONENSIS

A.S.C. Spec. No.	Length		Abdomen Length		Total Length	Pectine Teeth R/L	Movable Finger Length
	Carapace	Telson	Pre-	Post-			
			Males				
311.13	4.3	3.8	9.4	13.8	31.3	34/34	4.5
477.1	9.3	8.6	19.1	34.7	61.7	36/34	9.5
11	10.8	10.3	20.5	39.4	81.0	32/33	10.3
194.1	11.5	11.3	25.0	46.7	94.5	34/33	12.0
19	11.6	11.5	22.7	47.3	93.1	35/34	11.8
482.0	12.0	11.7	22.5	46.0	92.2	33/35	12.9
493	12.0	11.8	23.5	49.8	97.1	38/39	13.0
264	12.0	12.4	30.4	49.2	104.0	36/35	12.0
494	12.4	12.3	29.7	51.6	106.0	34/34	12.8
9	12.5	11.9	19.3	50.0	93.7	35/35	12.7
18	12.5	12.1	29.3	51.3	105.2	36/33	13.2
14A	12.8	12.8	23.0	53.4	102.0	39/39	14.4
406	12.9	13.1	28.0	53.5	107.5	34/35	14.1
447.4	13.0	13.0	26.0	53.0	105.0	35/34	14.0
490	13.1	12.5	25.0	51.2	101.8	34/33	13.5
498	13.2	12.6	32.6	52.0	110.4	34/34	13.8
497	13.3	13.0	29.0	52.8	108.1	38/38	13.9
20	13.5	13.2	26.2	54.1	107.0	38/37	14.4
486.0	13.5	13.4	32.3	54.0	113.2	37/39	13.7
491	13.5	13.5	28.0	55.4	110.4	36/35	13.7
506	14.7	14.6	27.3	61.9	118.5	35/35	15.7
			Females				
311.12	3.4	3.7	8.7	14.6	30.4	27/27	4.5
311.14	4.1	3.6	6.6	12.7	27.0	25/26	4.3
311.11	4.1	3.9	9.2	13.5	30.7	29/30	4.2
342.10	9.0	8.6	13.5	31.3	52.4	29/27	8.5
500	10.5	10.2	27.7	38.5	86.9	30/29	10.0
504	11.1	10.5	27.4	38.8	87.8	31/33	10.6
124.1	11.4	11.3	26.4	40.2	89.3	29/29	11.2
353	11.6	11.3	28.0	41.1	92.0	29/29	11.0
477.2	11.8	11.2	30.5	41.4	94.9	32/30	11.7
347	12.2	11.2	24.6	44.2	92.2	30/30	11.6
481.0	12.8	11.6	28.7	45.2	98.3	27/26	12.7
265.2	12.8	12.2	26.7	46.2	97.9	28/29	12.2
10	13.0	12.1	17.4	47.6	90.1	$29^{1}/_{2}$/29	12.3
343.3	13.0	12.5	16.0	48.2	89.7	27/27	12.6
194.2	13.1	12.2	31.2	43.7	100.2	28/28	12.5
13B	13.5	13.2	33.7	50.1	110.5	32/34	14.1
505	13.6	12.6	22.4	48.4	97.0	28/29	13.6
61.1	13.6	13.2	31.7	50.8	109.3	28/28	13.2
344.4	13.7	13.3	31.4	49.5	107.9	29/28	12.6
13A	13.8	13.2	27.3	40.6	94.9	$32^{1}/_{2}$/33	14.2
343.9	13.9	12.7	23.2	49.7	99.5	25/24	13.2
201	14.5	13.8	27.6	52.0	107.9	$29^{1}/_{3}$/29	14.5

Dorsal Preabdomen: Most of the dorsal surface primarily a date brown intermingled with a dusty gray and some yellow. Posterior half of each sclerite quite shiny and nearly black; anterior half grayish. Lateral margins of the preabdomen yellow. Seventh sclerite entirely yellow except for darker granules and a reddish median streak.

Ventral Preabdomen: Most of preabdomen extremely pale green; book lungs very light yellow. Entire pectines wider on male than on female. This difference made up mainly by longer teeth. Teeth: female, 28–34; male, 32–39.

Cauda: Entire cauda light yellow except for black aculeus with reddish base. Granules on segments 4 and 5 quite noticeably red. Vesicle usually as broad as or broader than segment 5.

APPENDAGES: Light yellow in color. Granule rows fairly well developed on inferior face of femurs of legs 2 and 3; weaker on legs 1 and 4. Pedipalps light yellow in color. Sometimes fingers bear slight reddish tinge other than that produced by the reddish granules. Movable finger may be longer than, as long as, or shorter than, carapace. This relationship is quite variable. However, it is more frequently longer than the carapace on the male and shorter on the female.

LOCALITY RECORDS: 2 ♂, 1 ♀, nos. 9, 10, 11, Casa Grande National Monument, Coolidge, Arizona (N. N. Dodge), A.S.C.; 2 ♀, 1 ♂, nos. 13A, 13B, 14A, Boulder City, Nevada (R. K. Grater), A.S.C.; 1 ♂, no. 18, Mesa, Arizona (D. K. Millet), A.S.C.; 1 ♂, no. 19, Mesa, Arizona (Mrs. J. L. Lewis), A.S.C.; 1 ♂, no. 20, Gila Bend, Arizona (J. K. Osgood), A.S.C.; 1 ♀, no. 61.1, Tucson, Arizona (E. M. Payton), A.S.C.; 1 ♀, no. 124.1, Granite Reef near Mesa, Arizona (Joe Patterson), A.M.N.H.; 1 ♂, no. 194.1, Stewart Mt. Dam, Arizona (D. LeBaron), A.S.C.; 1 ♀, no. 201, Yuma, Arizona (R. W. Ashe), A.S.C.; 1 ♂, no. 264, Gilbert, Arizona (Diane Smith), A.S.C.; 1 ♀, no. 265.2 (H. G. Troutman), A.M.N.H.; 6 ♀, 1 ♂, nos. 311.11–311.14, 342.10, 343.3 and 343.9, Tucson, Arizona (Peter Steckler), A.M.N.H.; 1 ♀, no. 347, Phoenix, Arizona (R. Johnson), A.M.N.H.; 1 ♀, no. 353, Bumble Bee, Arizona (L. Conaway), A.S.C.; 1 ♂, no. 406, Ehrenberg, Arizona (H. L. Stahnke), A.S.C.; 2 ♂, 1 ♀, nos. 477.1, 477.2, 477.4, Dateland, Arizona (unknown), A.S.C.; 1 ♀, no. 481, Papago Saguaro National Monument, Tempe, Arizona (E. Pomeroy), A.S.C.; 1 ♂, no. 497, Papago Saguaro National Monument, Tempe, Arizona (C. Fleming, Jr.), A.S.C.; 1 ♂, no. 482, San Tan, Arizona (Mrs. Betterton), A.S.C.; 1 ♂, no. 486, Mesa, Arizona (unknown), A.S.C.; 1 ♂, no. 490, Citrus Valley, Arizona (N. D. Benson), A.S.C. 1 ♂, no. 491, Buckeye, Arizona (L. Barron), A.S.C.; 1 ♂, 1 ♀, nos. 493 and 504, Kingman, Arizona (E. Railsback), A.S.C.; 1 ♂, no. 194, Scottsdale, Arizona (V. Bolt), A.S.C.; 1 ♂, no. 498, Mesa, Arizona (B. C. Sexton), A.S.C.; 1 ♀, no. 500, Sacaton, Arizona (L. Tibbet), A.S.C.; 1 ♀, no. 505, Tempe, Arizona (H. L. Stahnke), A.S.C.; 1 ♂, no. 506, Parker Dam, Arizona (W. W. Noah), A.S.C.

Hadrurus aztecus Pocock[1]

Hadrurus aztecus POCOCK, 1902, Biologia Centrali-Americana, Scorpiones, Pedipalpi, Solfugae, p. 7; EWING, 1928, Proc. U. S. Natl. Mus., vol. 73, p. 9; HOFFMAN, 1931, An. Inst. Biol. Mexico, vol. 2, pp. 340–346.

The posterior two-thirds of the carapace and the dorsal plates of the trunk are black (very dark brown). The anterior third of the carapace (in front of the ocular tubercle) is light yellowish in color. (Similar to *H. arizonensis* and *H. hirsutus*.) The postabdomen with the vesicle, the pedipalps (except the fingers), and the legs are also light yellow. The fingers are darker (similar to *H. spadix*). In all the males on hand a stronger contrast among the dark and light parts was evident than on the females. In live females one can barely notice the color differences.

TABLE 4

HADRURUS AZTECUS

LOCALITY	LENGTH CARAPACE	LENGTH TELSON	ABDOMEN LENGTH PRE-	ABDOMEN LENGTH POST-	TOTAL LENGTH	PECTINE TEETH R/L	MOVABLE FINGER LENGTH
			Males				
Tomellín, Oax.	11.5	11.6	27.8	46.1	97.0	37/37	11.5
Zapotilán, Pue.	12.1	13.0	23.5	51.7	100.3	Incomplete	13.3
			Females				
Chilpancingo, Gro.	13.0	12.5	27.6	41.4	94.5	29/29	12.0
Iguala, Gro.	14.7	14.0	28.8	48.0	105.5	27/27	14.0
Cuicatlán, Oax.	15.0	14.7	34.0	50.4	114.1	32/32	13.2

CARAPACE: On the male, the anterior third (in front of the ocular tubercle) light yellow; remainder black or very dark brown. Anterior part of carapace on female a little lighter than the rest and the granulations few in number and smooth. On the male the light anterior part covered with heavy, but isolated, granules; two transverse furrows in sides of ocular tubercle thickly covered with finer granules of variable size; entire posterior part has numerous large granules arranged in orderly series.

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[1] Entire description taken from Hoffman, 1931, An. Inst. Biol. Mexico, vol. 2, pp. 340–346.

DORSAL PREABDOMEN: Dorsal plates of the male black (very dark brown). Those of the female brown with a few diffuse darker spots.

VENTRAL PREABDOMEN: Ventral plates of the male more or less blackish and completely covered with punctiform depressions and transverse wrinkles. Patches of granulations of extensive and variable development noted on the first plate, under the pectines and on the sides of all the plates. Ventral plates of the female a little lighter brown than the dorsal surface. Pectine teeth: male, 37; female, 27–32.

CAUDA: Entire cauda a light yellowish color, and more or less the same tone as *H. hirsutus*. Aculeus black. Keels darker, in particular the inferior ones. On the base of only the male aculeus two small oval enlargements.

APPENDAGES: Legs of the male light yellowish, but those of the female light yellow ocher. A double longitudinal series of dentiform granules on interior face of femur of legs 1 to 4; well developed on legs 2 and 3, but incomplete and weak on 1 and 4.

PEDIPALPS: Light yellowish in color with bristles weaker and less dense than *II. hirsutus*. Fingers darker. Movable finger of the adult male same length or longer than carapace; on female always shorter than the carapace.

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LATE MIOCENE BEAVER FROM SOUTHEASTERN MONTANA

BY HORACE ELMER WOOD, 2ND

The geologic age of the youngest consolidated formation of southeastern Montana and northwestern South Dakota has never been established. One of the problems that I undertook for the field season of 1941 was to determine the age of this 200-foot, cliff forming sandstone, which overlies the White River series and caps Slim Buttes and Short Pine Hills in Harding County and Castle Rock and Deer Ears Butte in Butte County, South Dakota, and Chalk Buttes, Long Pine Hills, Ekalaka Hills, and smaller mesas in Carter County, Montana. (For maps see Bauer, 1924; Perry, 1935; Kirby, 1932; Rothrock, 1937.) These beds were first recognized by Todd (1895) in South Dakota. He considered them as "doubtless of the Loup Fork age," though without tangible evidence. Following Darton (1909), they have always been called either "Arikaree" or "Arikaree (?)," chiefly because they overlie the White River, like the type Arikaree in northern Nebraska and the comparable deposits of southern South Dakota. After the usual lack of success in attempting to collect fossils in these deposits, in northwestern South Dakota, I was delighted to discover (on June 30, 1941) an unidentified rodent jaw, obviously of late Tertiary aspect, in the museum of the Carter County Geological Society at Ekalaka, Montana. This specimen had been collected in 1914 by Mr. Thorvald Senrud, a local ranchman, on top of "Fighting Butte" (also known as "Starvation Butte" or "Poverty Butte"), a small outlier, not shown on any published map, at the northwest tip of fish-hook-shaped Chalk Buttes, just off the barb. Mr. Senrud presented this specimen to the Geological Society Museum in June, 1939. In view of the scientific value of including the specimen in a large research collection, the Carter County Geological Society has generously presented it to the American Museum of Natural History.

State Senator Walter H. Peck, Director of the Museum of the Carter County Geological Society, courteously lent me this specimen for study and authorized its transfer to the American Museum of Natural History. Miss Idella Kennedy, of the Society, guided me to the Fighting Butte locality, which she had previously visited with Senator Peck. Dr. Florence Dowden Wood collaborated with me in the field and made the accompanying illustrations with the assistance of Mr. John C. Germann. Lt. Col. Albert Elmer Wood offered suggestions at various stages of this study and read the manuscript critically. The field work was assisted by the Penrose Fund of the Geological Society of America, project grant No. 389/41.

Although, morphologically, this specimen can speak for itself, its stratigraphic significance depends on the authenticity of the locality. Senator Peck's good faith and competence are known to all his friends in vertebrate paleontology, and he vouches for Mr. Senrud's reliability. Senator Peck, with his customary methodical approach, revisited the locality with Mr. Senrud, who pointed out exactly where, on top of the butte, he had found this jaw (loose, according to Senator Peck's recollection).

Since then, a rock fall has changed the top of Fighting Butte from being merely difficult of access to being inaccessible (except for a mountaineer with special equipment), but the cap rock is clearly the same as that of the adjoining Chalk Buttes, and agrees with the adhering matrix remnants of the beaver jaw. I found a loose slab in the debris of the rock slide, apparently of the cap rock and definitely not of the underlying Brule, containing unidentifiable fragments of fossil bone and teeth, suggesting that this locality is a little less unfossiliferous than the rest of the formation.

A severe critic can readily imagine possibilities of error. Up to a generation ago, Indian skeletons and artifacts were still numerous on top of Fighting Butte, marking the site of a battle and siege between two Indian tribes, which resulted in the eventual death of the besieged group and gave the butte its name. This fossil might have been in the medicine bag of one of the dead Indians; or a later curio hunter could conceivably have picked it up elsewhere, and then left it on top of the butte; Mr. Senrud might have obtained it elsewhere and become confused about it (although this seems hardly likely, in view of his precise recollection). All of these and other objections, however, conflict with the following considerations. There is no higher formation from which this specimen could have been washed or otherwise brought down. A rodent of late Miocene affinities could not have been carried up from the Oligocene White River, which is the next older unit exposed anywhere in the area, still less from any older formation. There are various remnants of the matrix adhering; in particular the pulp cavity of the incisor is filled with a fine light gray sandstone, which agrees lithologically with the finer grained parts of the Carter County "Arikaree." The only bed that could possibly be of the right age to contain this rodent, within at least 200 miles in any direction, is the "Arikaree" cap rock itself. In view of all these circumstances, and since no one had previously suspected the correlative significance of this specimen, it would be an extraordinarily improbable coincidence if either an Indian or anyone else had brought this specimen some hundreds of miles and then left it on one of the relatively minute remnants of this lithologically suitable formation of, possibly, the correct age. Certainly, the principle of parsimony would make us assume that the jaw is actually from the cap rock, hence assigning an age of either upper Miocene (Barstovian) or thereabouts, thus, in essentials, returning to Todd's guess. These deposits may now be considered the northernmost outliers of the Ogallala group, but, in view of the distance from any other outcrops of the Ogallala and of the lithological distinctness of this cap rock, it will probably be desirable to distinguish it as a distinct unit. Except for the Flaxville gravel of northern Montana (Collier and Thom, 1918) and the Wood Mountain gravels of Saskatchewan (Sternberg, 1930) to which this consolidated cliff forming sandstone shows little resemblance, this is by far the northernmost deposit of this general age in the Great Plains area (Wood *et al.*, 1941) and helps to enlighten our previous ignorance regarding the geological history of the northern plains between the Oligocene and Pleistocene.

ORDER RODENTIA

Family Castoridae

Monosaulax senrudi, new species

Figure 1

TYPE: A.M.N.H. No. 39415. Greater part of left ramus mandibuli, with P_4 and M_{1-3} essentially intact, and the base of the incisor.

HORIZON: About Barstovian (upper Miocene).

LOCALITY: On top of Fighting Butte, at the northwest tip of Chalk Buttes, section 30, Township 1 South, Range 57 East, Carter County, Montana, about 22 miles from Ekalaka by road and trail, but about 14 miles southwest of it by air, and about 3 miles beyond the Poncelet Ranch, C.C.G.S. Locality No. V-39-6.

DIAGNOSIS: Size and evolutionary stage intermediate between *Monosaulax* and *Amblycastor;* fine, slightly divergent striations on the convex enamel face of the incisor; posterior end of incisor definitely lingual to the coronoid process; cheek teeth almost hypsodont; internal end of hypoflexid interpolated between mesofossettid and metafossettid; fossettids (enamel lakes) usually simple and nearly transverse; P_4 considerably longer than any of the molars, mesio-distally; M_2 the widest of the cheek teeth, bucco-lingually; M_3 definitely the smallest cheek tooth; coronoid process more prominent and distinct than in either *Amblycastor* or *Monosaulax.*

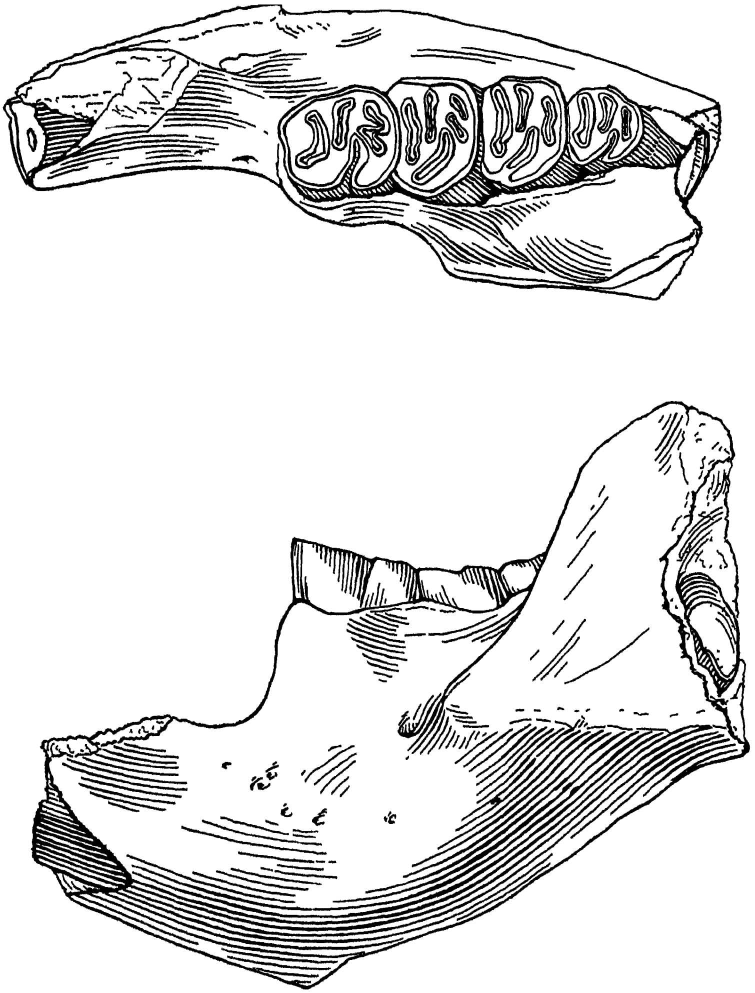

Fig. 1. *Monosaulax senrudi*, type, A.M.N.H. No. 39415, left ramus, crown and buccal views, × 2.

Generic Assignment: This is obviously a castorid rodent, showing special resemblances only to *Amblycastor* and *Monosaulax*, from North America, and to "*Steneofiber*" *depereti*, from the French Burdigalian. The Montana specimen shows faint, slightly divergent striations on the enamel face of the incisor almost exactly like those of "*Steneofiber*" *depereti*, A.M.N.H. Nos. 15588 and 22524, from the Sables d'Orléans, but the incisor is more rounded in cross section, and there is no special resemblance in the cheek teeth, since "*S.*" *depereti* is much more specialized, hypsodont, and *Dipoides*-like.

Comparisons with *Monosaulax*, especially with *M. pansus*, A.M.N.H. No. 18902, and four mandibular rami lumped as No. 17216, and with *Amblycastor fluminis*, especially A.M.N.H. Nos. 22068 and 18908, are considerably closer. These two genera show the closest analogues to the simple, transversely trending fossettids of the Montana form. The enamel surface of the incisor of *Monosaulax* is smooth, unlike the Montana specimen, but the shape in cross section is similar, as is the size of the geniohyoid pit. All previously described species of *Monosaulax* are markedly smaller than *M. senrudi.* In little-worn *Monosaulax* cheek teeth, the hypoflexid seems to continue the curve of the metafossettid; wear would make it closer to, but still distinct from, the Montana specimen. In the other direction, *Amblycastor fluminis* is much larger than the Montana specimen, with heavy parallel grooves on the enamel surface of the incisor, and the incisor is compressed mesiodistally. There are some special resemblances in the pattern of the cheek teeth not found in *Monosaulax pansus,* especially the anterior concavity of the parafossettid and a tendency for the metafossettid to be twinned, although the metafossettid of *M. pansus* does not show the distortion found in the anterior teeth of the Montana form. The hypoflexid continues the curve of the metafossettid in A.M.N.H. No. 22068; on the other hand, in A.M.N.H. No. 18908, it projects lingually between the mesofossettid and metafossettid, much as in *M. senrudi.* The geniohyoid pit is less prominent in *Amblycastor fluminis,* and the coronoid process is relatively smaller and less sharply modeled. In A.M.N.H. No. 22068, the posterior end of the incisor is well outside (buccal to) the plane of the coronoid process, but in A.M.N.H. No. 18908, it is nearly in the same plane as the coronoid process, and thus much closer to the Montana specimen.

Altogether it is clear that there are significant resemblances to (as well as real differences from) both *Monosaulax* and *Amblycastor.* I originally intended to call this a small, primitive species of *Amblycastor;* however, Lt. Col. A. E. Wood considers the assignment to *Monosaulax* more convenient, although we suspect that a more complete specimen would be generically distinct from any known form. I have been glad to be guided by his special knowledge of the Rodentia. The intermediate position between *Monosaulax* and *Amblycastor,* in both size and structure, may indicate a more or less intermediate phyletic stage, tending to associate these two genera more closely than Stirton (1935) apparently considered probable.

DESCRIPTION: The jaw is thoroughly infiltrated and quite strong. Remains of a thin limonitic film are attached to various parts of the jaw and teeth. A number of larger quartz grains stand out in the adhering remnants of a fine sandstone matrix. All the bone behind M_3 is lost, thereby exposing the broken tip of the backward directed posterior root of M_3 and the open pulp cavity of the incisor, directly under the rear border of M_3. The mental foramen is ventral to the rear of the diastema. The anterior border of the symphysis is a straight slope to the rear, with a ventral projection, as in beavers generally. A fair-sized pit, just behind the rear border of the symphysis, doubtless lodged the insertion of the geniohyoid muscle. The crown of the incisor is broken off flush with the alveolar border, forming a cross section with the shape of a rounded isosceles triangle. The enamel face of the incisor carries fine striations as in *"Steneofiber" depereti,* making a surface which seems almost smooth in comparison with the coarse striations of *Amblycastor.* (Previously described species of *Monosaulax* have entirely smooth incisors.) The row of cheek teeth is inclined lingually, out of the plane of the jaw, as in other beavers. The animal was presumably an individual in fairly late maturity, as the teeth are worn down until the root divisions are in sight; for the same reason, the pattern remnants of the crown are relatively simplified. (Stirton's convenient terminology [1935] is followed.) The three valleys on each tooth which, in less worn teeth, would have lingual outlets are isolated on each tooth as the parafossettids, mesofossettids, and metafossettids; the single valley with a buccal outlet still escapes freely on P_4 and M_3, and barely on M_2, as a hypoflexid; it forms an isolated hypofossettid on M_1. P_4 shows a faint median vertical groove on the anterior (mesial) surface, and a sharper groove, the hypostriid, down the buccal surface from the hypoflexid; its parafossettid is concave anteriorly. The metafossettid shows a tendency to be twinned in the mesial members of the series: on P_4, it has the shape of a compressed Z; on M_1, at this stage of wear, it is separated into two lakes which are off-set; on M_2, this condition is incipiently suggested by a wavy metafossettid. All the other fossettids are rather simple, flattened loops, trending transverse to the tooth row. There is considerable interproximal wear (cf. Wood, 1938) between the cheek teeth, chiefly from the tooth in front grinding into the tooth behind it. It would appear that M_1 has ground through the enamel on the anterior (mesial) surface of M_2, and M_2 through that of M_3, after which some dentine was worn away. As an alternative interpretation, it is possible that enamel had never been deposited on the anterior (mesial) surfaces this close to the roots of the teeth (cf. A. E. Wood, 1940, fig. 116). X-rays of the specimen, courteously furnished by Dr. Ramsay Spillman, do not point conclusively to either interpretation, but such evidence as exists is in favor of originally continuous enamel. Another, and possibly more decisive, line of evidence is the profile, along the median line of the tooth, of the most anterior portion of the dentine surface of the crown. It is concave superiorly, indicating previous partial protection from attrition (i.e., by enamel) both mesially and distally, with not enough wear since the removal of the enamel from the mesial surface of the tooth to alter the profile essentially. When, however, a rodent tooth has lacked this protection for the mesial surface from the start of coronal attrition, the corresponding profile is a convex curve forward and upward, that is, the mesial and crown surfaces merge into a curve at the edge, presumably due to the attrition of food, in particular, striking the dentinal edge from both directions. The most striking of all the effects of interproximal wear is the deep concave recess which P_4 has ground into the anterior (mesial) surface of M_1.

MEASUREMENTS OF TYPE OF *Monosaulax senrudi* IN MILLIMETERS

Length I_1 root, along outer curve	149	(est.)
Diastema	14.7	
P_4–M_3, greatest length, mesio-distally	25.9	(actual)
M_1–M_3, greatest length, at base of crown	17.8 18.1	(actual) (est.)[1]
P_4, greatest length (crown)	8.2	
P_4, greatest width (crown)	6.9	
M_1, greatest length (crown)	5.2 6.1	(actual) (est.)[1]
M_1, greatest width (base of crown)	7.3	
M_2, greatest length (crown)	6.1	
M_2, greatest width (crown)	6.7	
M_3, greatest length (base of crown)	5.9	(crown, 5.5)
M_3, greatest width (crown)	5.7	
Depth jaw below P_4, buccal surface	22.0	
Depth jaw below P_4, lingual surface	19.3	
Depth jaw below M_3, buccal surface	17.9	
Depth jaw below M_3, lingual surface	14.0	
Length of symphysis	20.2	

GEOLOGIC INFERENCES: It has already been pointed out that the assignment of this species to *Monosaulax* is largely a matter of convenience and is open to considerable doubt. Nevertheless, whether this is really a specialized *Monosaulax*, or a primitive *Amblycastor*, or a borderline species, or a new genus related to both, it would still indicate an age that could hardly be far from late Miocene (i.e., Barstovian), and would strongly oppose any assignment to the lower Miocene, whether to the Arikaree group proper or to Arikareean time. Therefore, the late Miocene sandstone of Harding and Carter counties can be thought of as the only known northern remnant of the thin Ogallala veneer, which is still spread so widely over the Great Plains, farther south. One would assume that much or all of the intervening area was covered with this Ogallala veneer in the late Tertiary, but that it has since been stripped off. The considerable time interval between the Oligocene White River series and the upper Miocene, at Slim Buttes, South Dakota, leaves time for local diastrophism and peneplanation (Wood, 1942) as an alternative to the hypothesis of large scale slumping, which seems generally accepted currently (Toepelman, 1923).

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[1] Although a good-sized embayment has been ground into the anterior face of M_1 by interproximal wear against P_4, it is possible to estimate closely what the original contour must have been.

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TWO NEW PSEUDOSCORPIONS OF THE GENUS DOLICHOWITHIUS

BY C. CLAYTON HOFF[1]

While studying the pseudoscorpions in the collections of the American Museum of Natural History, the writer found representatives of two new species belonging to the genus *Dolichowithius*. These are described in the present paper. The type specimens are mounted in Canada balsam and deposited in the American Museum of Natural History.

SUBORDER MONOSPHYRONIDA CHAMBERLIN, 1929

CHELIFERIDAE HAGEN, 1878

Withiinae Chamberlin, 1931

GENUS DOLICHOWITHIUS CHAMBERLIN, 1931

In the generic characterization given by Beier (1932a) for the genus *Dolichowithius*, there occurs the following statement: "*st* etwa in der Mitte zwischen *sb* und *t* stehend." This generic characteristic should be deleted since, in the male especially, the tactile seta *st* of the movable chelal finger is often much closer to *sb* than to *t*.

Dolichowithius solitarius, new species

Figures 1–2

MALE: Body fairly stout; yellow in color; 1.6 mm. long (abdomen somewhat contracted). Cephalothorax with posterior margin straight except for a very weak median projection; with six clavate setae along posterior margin; two transverse furrows, one near the midpoint of the cephalothorax, the other near the posterior margin; length about 0.67 mm.; greatest width about 0.6 mm. and located near the level of the median transverse furrow, rapidly narrowed anteriorly, slightly narrowed posteriorly; entire surface of cephalothorax coarsely granular, with a few clavate setae, of which about 20 are on the median disc between the two transverse furrows; a pair of eye spots present. Abdomen nearly 1 mm. long in treated specimen; width about three-fourths of the length; yellowish in color. Tergites with coarse scale-like sculpturing on the scuta; tergites 4 to 9 appear weakly divided; tergites 2, 3, and 10 seem obscurely divided; setae clavate; anterior tergites with a straight row of 8 to 10 marginal setae; maximum number of setae for each tergite about 16 in posterior tergites where the medial, central, and lateral setae of each scutum may be placed anterior to the row; setae of tergites 1 through 9 as follows: 8:10:10:10:12:12:14–16:12:14. Sternites except the anterior four and the eleventh appear divided, for the most part smooth; setae of sternites long and acuminate, usually forming a single marginal row of about five setae on each half-sternite and an additional lateral seta somewhat anterior to the row; sternites 7, 8, and 9 with median compact groups of setae between the sternal halves, each group consisting of between 15 and 20 small acuminate setae flanked on each side by a much larger acuminate seta. Each stigmatic plate apparently with two setae; pleural membranes marked by wavy longitudinal plications.

Chelicera: Length 0.2 mm., width of base 0.12 mm.; laminal and interior setae long, simple, acuminate; basal and subbasal setae with subterminal dentations and shorter than the laminal and interior

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[1] Quincy College, Quincy, Illinois. This study was assisted by a grant from the American Association for the Advancement of Science through the Illinois State Academy of Science.

setae; exterior seta acuminate; flagellum of four setae. Movable finger about 0.16 mm. long; galeal seta reaching slightly beyond the tip of the galea; galea a straight stalk, weakly trifurcated near the distal end; movable finger with two subapical lobes on the inner margin; more than 15 (position precludes an accurate count) plates in the serrula exterior. Fixed finger with a well-developed but very transparent lamina exterior; serrula interior with the distal tooth spine-like and serrate, the three more proximal teeth plate-like and serrate, others fused into a velum; three well-developed denticles in the distal two-fifths of the inner margin of the finger.

Palp: Very much elongated; sum of lengths of femur and tibia approximate to the length of the body; palps light yellow in color with chelal fingers light reddish brown; setae of palps clavate to subclavate except for short, acuminate setae of chela; all podomeres except chela somewhat granular, the trochanter and femur more so than the tibia. Maxilla smooth on ventral face, granular on lateral surface; length 0.32 mm.; width 0.22 mm.; apical setae poorly developed. Trochanter with a rounded and weakly developed dorsolateral protuberance; flexor margin of trochanter evenly convex and markedly granular; length about 0.32 mm., 1.9 times the width. Femur very slender; widest near the distal one-fourth; granular; numerous clavate to subclavate setae, terminally denticulate; lateral margin convex but somewhat centrally flattened; flexor margin almost straight; length 0.82 mm.; width nearly 0.155 mm.; length 5.3 times the width. Tibia elongate; more pedunculate than the femur; extensor margin concave except near the ends; flexor margin very weakly convex; length 0.85 mm.; width 0.16 mm.; length 5.3 times the width. Chela moderately slender; not granulate; setae acuminate, with a few fine, subterminal denticulations; both extensor and flexor margins of chela evenly convex; hand narrowed gradually toward both base and fingers; widest near the center of the hand; length of chela without pedicle 1.01 mm., width 0.24 mm., length 4.2 times the width; depth of chela nearly equal to the width; hand without pedicle 0.55 mm. long; movable finger shorter than the hand, 0.46 mm. long. Marginal teeth of fixed finger contiguous, subacute, and conical in the distal part of the row but weaker and more bluntly rounded in the proximal part of the row, teeth about 35 in number, wanting from the proximal one-sixth of the fixed finger margin; marginal teeth of movable finger similar to those of the fixed finger. Fixed finger with eight tactile setae; external series with *esb* and *eb* at base of finger and separated by less than two areolar diameters, *et* removed from the tip of the finger by a little less than one-sixth of the finger length, *est* at about the midpoint of the finger and about equidistant from the finger tip and from *eb;* internal series with *it* and *ist* not over three or four areolar diameters apart and proximal to *est*, *isb* and *ib* near base of finger and at about the level of *esb* and *eb*, *isb* not separated from *ib* by more than three areolar diameters. Movable finger with four tactile setae: *t* about two-fifths of finger length from tip of finger, *sb* removed from the finger base by slightly more than the width of the finger at the level of *sb*, *b* separated from *sb* by about two areolar diameters, *st* twice as far from *t* as from *sb*.

Legs: Moderately stout; yellow in color; claws sickle-shaped, simple; setae subclavate to acuminate; subterminal seta simple; surface of many pedal podomeres with scale-like sculpturing. First leg with trochanter relatively deep, a few acuminate setae, surface apparently smooth; pars basalis of femur 0.133 mm. long, 0.14 mm. deep, setae sparse and paucidenticulate; articulation between pars basalis and pars tibialis little movable; weak, scale-like markings covering surface of both parts of femur; pars tibialis 0.26 mm. long, 0.15 mm. deep, flexor margin very weakly convex, extensor margin much more convex, setae of flexor margin acuminate to subclavate, setae of extensor margin shorter and more clavate; tibia 0.29 mm. long, 0.09 mm. deep, greatest depth near the distal end, flexor margin convex, extensor margin basally convex but distally almost straight, relatively long acuminate setae on medial surface, subclavate setae on extensor surface, surface sculpturing very weak; tarsus with nearly straight margins, podomere narrower distally, length 0.277 mm., depth 0.057 mm., setae of flexor margin acuminate, setae of extensor margin denticulate, surface very weakly sculptured. Fourth leg with trochanter stout, few acuminate setae; femur with pars basalis subtriangular, surface smooth, a few long and acuminate setae especially on the flexor surface, length 0.192 mm., depth 0.145 mm., flexor margin convex in the basal half; pars tibialis much wider than pars basalis, flexor surface almost straight, extensor surface very convex especially proximally, surface especially on the extensor side with scale-like markings, setae of extensor surface denticulate and subclavate, setae of flexor surface acuminate; length of pars tibialis 0.44 mm., depth 0.225 mm.; entire femur stout, length 0.53 mm.; tibia stout, deepest near the distal one-third, length 0.405 mm., depth 0.118 mm., flexor margin markedly convex, extensor margin weakly convex, setae of the flexor margin acuminate, setae of extensor margin subclavate, surface of podomere with weak, scale-like sculpturing; tarsus very weakly sculptured, margins nearly straight, setae of flexor margin acuminate, those of extensor surface subclavate to clavate, length 0.325 mm., depth 0.061 mm.; very long tactile seta of extensor margin of tarsus inserted nearly two-thirds of podomere length from proximal end.

Genital complex: Sex organs simple; six or eight sensory setae on each side anterior and lateral to the genital opening; posterior operculum with three or four setae on each side of the median line.

Female: Unknown.

Type Locality: The single specimen, the male holotype, from a collection labeled "Costa Rica." No other data available.

Dolichowithius solitarius is closely related to three *Dolichowithius* species in which the palpal podomeres are very long and slender. From one of these, *D. extensus* Beier, 1932, our form is easily separated by the stouter and shorter palpal podomeres. Separation of our species from the other two related forms, *D. vicinus* Beier, 1932, and *D. longichelifer* (Balzan, 1890), is a little more difficult. A study of the literature (Beier, 1932a, 1932b) indicates that *D. vicinus* has palpal podomeres considerably longer than in our form; the palpal femur and tibia are more slender but the chela is stouter in *D. vicinus* than in *D. solitarius*. From *D. longichelifer* our form may be distinguished by a difference in the shape of the chelal hand since, when viewed from above, *D. solitarius* has a more convex extensor margin and a more evenly convex flexor margin; also *D. solitarius* has a more marked concavity on the external margin of the palpal tibia. These differences are clearly seen when a comparison is made between our specimen and the figure given by Beier (1932a, fig. 224) for *D. longichelifer*. A difference also exists in the position of the tactile setae of the movable finger. For *D. longichelifer*, Beier (1932a) writes "*st* etwa in der Mitte zwischen *sb* und *t* befindlich." In *D. solitarius*, *st* is twice as far from *t* as from *sb*.

Dolichowithius granulosus, new species

Figures 3–5

Male: Measurements and ratios of the holotype are followed in parentheses by the corresponding measurements and ratios of the paratype when the holotype and paratype differ significantly. Body moderately stout; yellow in color; 1.75 mm. long. Carapace very granular; two transverse furrows present; widest near the center at the anterior transverse furrow, rapidly narrowing anteriorly; posterior width a little less than the greatest width; posterior margin straight, with six marginal setae; anterior margin medially straight, with four setae; all setae of carapace clavate; two eye spots present; length of carapace 0.69 (0.66) mm., greatest width 0.56 (0.5) mm., posterior width 0.51 (0.45) mm. Abdomen stout, about 1.1 mm. long, 0.75 (0.65) mm. wide. Tergites, except the first and eleventh, divided, often obscurely so; scuta of tergites with heavy, scale-like sculpturing, setae clavate and forming a single transverse row at the anterior end of the abdomen but with a median and a lateral seta anterior to the row in each of the central and posterior scuta; formula for chaetotaxy of tergites 1 through 10 as follows: 6–8: 6–8:8:10:10:12–14:12:10–12:10–12:10. Sternites weakly divided, very weakly sculptured, setae acuminate, maximum number in any sternite 14; compact areas of bristles on sternites 7, 8, and 9; number of setae in bristle areas variable, usually about 12 setae in the area on sternite 7 and 15 to 20 setae on each of the other two sternites. Each anterior stigmatic plate with one large acuminate seta, each posterior plate with two; pleural membranes with wavy plications, rugose in general appearance.

Chelicera: Fairly stout; about 0.18 mm. long, width of base 0.11 (0.102) mm.; yellow to grayish yellow in color; base smooth; interior and laminal setae long and acuminate; subbasal and basal setae relatively stout and with a few subterminal denticulations; the exterior seta acuminate; flagellum of four well-developed setae, the longest and distalmost one unilaterally serrate along the distal one-third of the anterior margin. Fixed finger slender; lamina exterior well developed; inner margin of finger with three large denticles confined to much less than the distal half of the margin; three small denticles closely spaced along the inner margin of the apical tooth; serrula interior with the distal tooth serrate and spine-like, the three more proximal teeth ligulate or plate-like and also with serrate margins, other teeth fused into a velum. Movable finger little curved, relatively much stouter than the fixed finger; apical tooth terminally bicuspid; serrula exterior of 17 or 18 ligulate plates; two subapical lobes located very close to the apical tooth; galeal seta inserted on a level with the more proximal subapical lobe and reaching nearly to the end of the galea; galea straight, fairly stout, with three or four acute and short subterminal and terminal rami.

Palpus: Moderately slender; yellowish red to golden color with the chela a little darker than the rest of the palp; chela smooth and with relatively long, acuminate to paucidenticulate setae; other podomeres moderately granular, with paucidenticulate to clavate setae; palp somewhat longer than the body. Maxilla with the ventral surface smooth, lateral surface granular; setae acuminate, apical process with two poorly developed apical setae; length 0.37 (0.31) mm., width 0.22 (0.19) mm. Trochanter fairly stout; flexor margin evenly convex, granular, with numerous denticulate setae; extensor surface with a dorso-lateral protuberance and with two or three clavate setae; length of trochanter about 0.32 mm., about 1.9 times the width. Femur with surface granular; pedicle fairly well developed; flexor margin virtually straight except near the ends; extensor margin convex but much flattened in the central portion; setae of flexor surface subclavate; setae of the extensor surface subclavate to clavate; length of femur 0.62 (0.57) mm., greatest width at about the distal one-fourth and equal to 0.152 (0.145) mm.; length about 4.1 (3.9) times the greatest width. Tibia equal in length to the femur but somewhat stouter; most setae paucidenticulate; surface granular; pedicle as long as wide; flexor margin convex with a slight concavity near the distal end; extensor margin virtually straight between the pedicle and the distal fourth, distally the margin is angular; length 0.62 (0.56) mm., width 0.175 (0.167) mm.; length 3.55 (3.35) times the width. Chela from the dorsad with the extensor margin flatly convex and the flexor margin evenly convex; pedicle near the center of the base; setae subacuminate, paucidenticulate, relatively long; hand and fingers smooth; fingers gently curved, fairly stout; chela without pedicle 0.875 (0.85) mm. long, width 0.245 (0.23) mm., length 3.55 (3.7) times the width; hand 0.45 (0.44) mm. long; finger but little shorter than hand and measuring 0.44 (0.42) mm. in length; depth of chela subequal to the width. From the side, dorsal margin of chela evenly convex, ventral margin flatly convex; movable finger curved with outer margin convex, inner margin concave; fixed finger stouter than movable finger, central portion of the outer margin weakly convex to nearly straight, inner margin convex. Fixed finger with between 30 and 35 contiguous, rounded teeth, each of which has a papillose cusp placed slightly toward the proximal corner of the tooth; movable finger with about 35 teeth similar to the teeth of the opposing finger. Movable finger with four tactile setae: *t* just distal to the midpoint of the finger and midway between *b* or *sb* and the finger tip, *st* about midway between *t* and the proximal margin of the finger, *sb* removed from the finger base by about the width of the finger at the level of *sb*, *b* about one areolar diameter proximal to *sb*. External series of fixed finger with *et* about one-fifth of the finger length from the tip, *est* near the midpoint of the finger, *esb* and *eb* near base of finger and separated by less than two areolar diameters; internal series with *it* and *ist* separated by less than two areolar diameters and located a little proximal to the level of *est*, *isb* and *ib* located at about the level of *esb* and *eb*.

Legs: Fairly stout; yellow in color; setae and sculpturing variable; tarsal claws and subterminal setae simple. First leg with trochanter suboval in shape, length about 0.15 mm., about 1.5 times the depth; pars basalis with flexor margin weakly convex and with a long pseudotactile seta toward the distal end, setae sparse and acuminate, surface partly sculptured with scale-like lines, length about 0.13 mm., length little more than depth; pars tibialis with flexor margin very weakly convex and almost straight, extensor margin evenly convex, scale-like sculpturing conspicuous, setae of extensor surface short and paucidenticulate, those of the flexor surface acuminate, length 0.26 (0.25) mm., depth 0.12 mm.; tibia with sculpturing as in the preceding podomere, numerous long acuminate setae on the flexor surface, almost asetaceous on the extensor surface, flexor margin evenly convex, extensor margin proximally convex but with a weak concavity in the distal two-thirds, length 0.29 (0.275) mm., depth greatest in the distal one-third and equal to 0.076 mm.; tarsus subcylindrical, margins nearly straight, sculpturing weak, setae fairly numerous, setae of flexor surface relatively long and acuminate, those of extensor surface shorter and with a few subterminal denticulations, length about 0.26 mm., 4.7 times the depth. Fourth leg with sculpturing and chaetotaxy as in the first leg; in general, setae of the flexor surface of podomeres are acuminate while those of the extensor surface are multidenticulate to subclavate; trochanter subcylindrical, about 0.19 mm. long, 0.13 mm. deep; bars basalis subtriangular, the distal portion of the flexor margin nearly straight, surface of podomere virtually smooth, acuminate setae on the flexor surface, length about 0.18 mm., depth 0.13 mm.; pars tibialis with the flexor margin nearly straight and continuous with the flexor margin of the pars basalis, the extensor margin evenly convex, length 0.43 (0.41) mm., depth 0.175 mm.; entire femur 0.52 (0.495) mm. long, 0.175 mm. deep; tibia with flexor margin convex, extensor margin proximally convex but distally straight to weakly concave, length 0.385 (0.375) mm., depth 0.095 mm.; tarsus subcylindrical with the greatest depth toward the proximal end, length 0.315 mm., depth about 0.06 mm. or slightly more; tactile seta of the extensor surface of the tarsus very long and located a little more than two-thirds of the podomere length from the basal margin.

Genital complex: Much as in the preceding species.

Type Locality: The male holotype and one male paratype in a collection made by W. G. Hassler from the upper Essequibo River, Onoro region, British Guiana, between December 13 and 17, 1937.

Dolichowithius granulosus can be separated from other species of the genus by the size and shape of the palpal podomeres. It seems closely related to *D. modicus* Beier, 1932, and *D. simplex* Beier, 1932, because of the moderately slender palpi.

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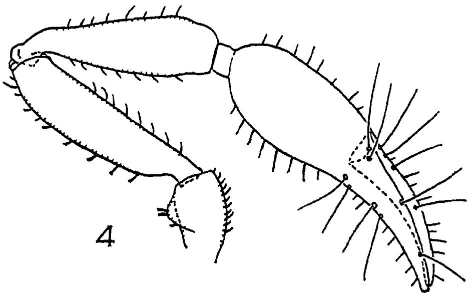

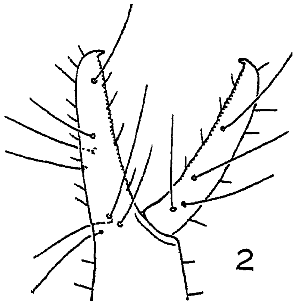

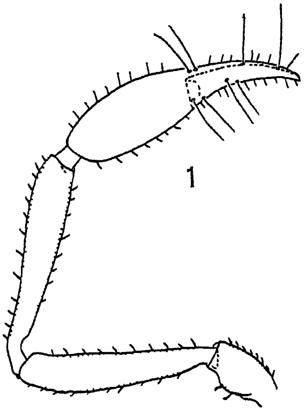

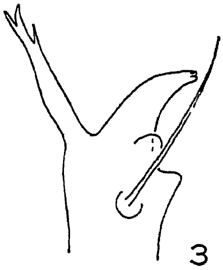

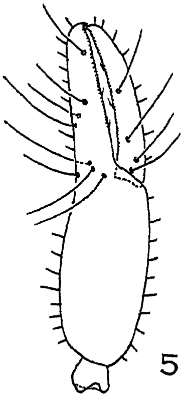

Dolichowithius solitarius, new species

Fig. 1. Dorsal view of palp with tactile setae of movable chelal finger omitted, male holotype.
Fig. 2. External view of chelal fingers, male holotype.

Dolichowithius granulosus, new species

Fig. 3. End of movable finger of chelicera, serrula exterior omitted, male holotype.
Fig. 4. Dorsal view of palp, male holotype.
Fig. 5. External view of chela, male holotype.

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THE HYOID BONES IN *PROTOCERATOPS* AND IN *PSITTACOSAURUS*[1]

BY EDWIN H. COLBERT

INTRODUCTION

During the preparation of a skeleton of *Protoceratops*, Mr. Otto Falkenbach of the American Museum Paleontological Laboratory discovered two small bones which when first seen appeared to be quite unlike any elements hitherto known in this dinosaur. At first it was thought that these bones might be portions of the sternum, but comparisons soon showed that such could not be the case. Indeed, various comparisons with the known osteological elements of *Protoceratops* confirmed the first impression, namely, that these were bones hitherto undescribed, so the question arose as to what these bones might be. Several possibilities were considered and several opinions were sought, with the result that Dr. William King Gregory of the American Museum suggested that these might be hyoid elements. The more this possibility was investigated, the more likely it seemed to be. All subsequent investigations have tended to confirm this view.

It has been felt desirable to bring out a description of these supposed hyoid bones, in order that the published knowledge concerning *Protoceratops*, contained in several papers but especially in the study by Brown and Schlaikjer (1940), may be as complete as possible. At the same time, it was felt that certain comparisons with other dinosaurs of varying relationships to *Protoceratops* should be included in this study. Such is the subject matter that will be treated in the following pages.

The author wishes to express his appreciation to Mr. Falkenbach, who in the course of his skillful preparation of the specimen of *Protoceratops* made the discovery of these new bones. To Dr. Gregory must go the credit of making the suggestion as to their being hyoids, and to him my fullest acknowledgments are hereby expressed. Subsequently a portion of another bone was found, and this may represent an additional element in the hyoid apparatus of *Protoceratops*. The translation from Fürbringer was made by Dr. Otto Haas. Finally credit should go to Mr. John C. Germann, Staff Artist, for the excellent illustrations that appear in this paper.

DESCRIPTION AND DISCUSSION

Before making a formal description of these supposed hyoids of *Protoceratops*, it may be well to consider briefly the homologies of the hyoid bones in the tetrapods, and their development particularly in modern reptiles.

A very illuminating statement describing the development and the homologies of the hyoids in modern reptiles was set forth by Fürbringer in his monograph on the hyoids of the vertebrates (1922). A translation of this statement follows:

"As has been known in the main for a long time, the hyoid of living reptiles consists, at its highest stage of development, of an unpaired body, the corpus (Copula; basihyal and basibranchial) [basibranchial and hypobranchial according to Goodrich] tapering in a forward direction into a narrower process, the *processus lingualis* (processus entoglossus), which varies in length and is bound into the posterior part of the tongue, and of three pairs of horns connected laterally in various ways with the corpus, an anterior pair, the cornu hyale, a middle pair, the cornu branchiale I, and a posterior pair, the cornu branchiale II, and these are derived from the ordinary hyoid arch and the first two gill arches. In the more primitive forms the cornu hyale is found to be connected with the columellar apparatus of the middle ear, also, an element in the hyoid arch, but this connection has been lost in most of the reptiles and has undergone considerable reduction in many of them. This horn is very significant morphologically and therefore has been named the cornu principale by Gaupp, but it is inferior in size and strength to the following horn. This horn, the *cornu branchiale* I, which is derived from the first branchial or third visceral arch, is dorsally free and it proves by its permanence and by the fact that it is ossified when all other

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[1] Publications of the Asiatic Expeditions of the American Museum of Natural History, Contribution No. 148.

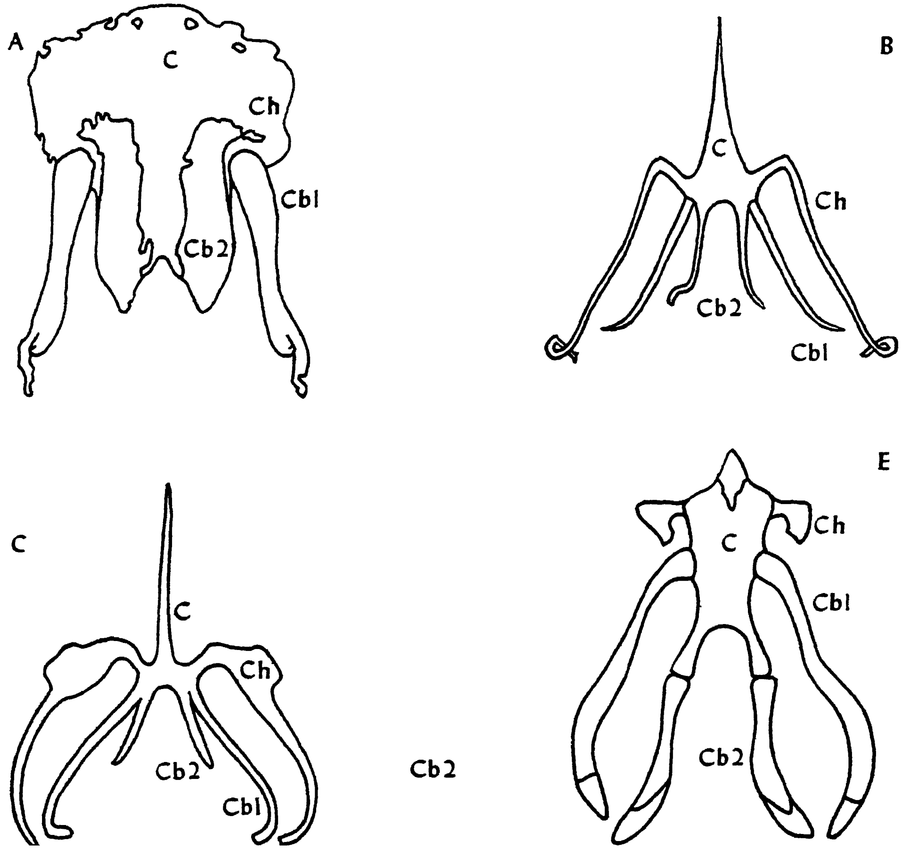

Fig. 1. A comparison of the hyoids in the living reptiles. A, Crocodilia: *Crocodilus*, original. B, Rhynchocephalia: *Sphenodon*, after Fürbringer. C, Squamata: *Lacerta*, after Goodrich. D, Squamata, *Vipera*, after Fürbringer. E, Chelonia: *Clemmys*, after Fürbringer. Not to scale. Key to abbreviations: C—corpus, including the hypohyal or entoglossal. Ch—ceratohyal and epihyal; cornu hyale. Cb1—ceratobranchial I: cornu branchiale I. Cb2—ceratobranchial II; cornu branchiale II.

portions of the hyoid are cartilaginous, to be the most prominent part of the hyoid complex. The *cornu branchiale* II, derived from the second branchial or fourth visceral arch, is considerably reduced, and frequently in many reptiles it is split up into a ventral and a dorsal portion, while it may disappear completely in some forms. This horn, too, is as a rule dorsally free, but in some isolated cases it is connected with the dorsal end of the cornu hyale. Starting with the highest level of development, the hyoid of many reptiles, most of which may be considered as advanced forms, is subject to reduction. This may start sometimes with the first horn, the cornu hyale, sometimes with the last one, the cornu branchiale II, or it may take place simultaneously at the anterior and posterior ends.

"(For a more detailed survey, reference is made to Gaupp's excellent synthesis of the ontogeny and phylogeny of the sound conducting apparatus in vertebrates as well as of the evolution of the cranial and the hyobranchial skeleton.)

"Simultaneously the hyoid bone constitutes in various ways the ventral basis and, when well developed, the support for the respiratory organs (larynx, i.e., cricoid, with adjacent cartilages, the trachea). The connection between both is sometimes loose, sometimes solid, and it may exist between hyoid and cricoid or between hyoid and trachea, with all transitions from the cricoid to the trachea" (Fürbringer, 1922, p. 6).

For the purpose of orienting ourselves and avoiding a long, detailed discussion, the manner in which the hyoid apparatus is developed in the modern reptiles may be shown by a diagram in which typical examples of the hyoids in turtles, rhynchocephalians, crocodilians, lizards, and snakes are pictured. This diagram will, of course, supplement the summary written by Fürbringer and presented above. Homologies are derived from a comparison with the condition in fishes.

Various names have been applied to the hyoid elements shown in this diagram. It may be well, therefore, to include at this place a table to show the system of nomenclature used for the hyoid elements by Fürbringer in 1922, as compared with the system used by Goodrich in 1930, and that followed by Camp in his classification of the lizards, 1923, and more recent papers.

FÜRBRINGER	GOODRICH	CAMP
Corpus	Corpus or Copula	Corpus
Entoglossal	Entoglossal process	Hypohyal
Cornu hyale	Hyoid cornu	Ceratohyal Epihyal
Cornu branchiale I	First branchial cornu	Ceratobranchial I Epibranchial I
Cornu branchiale II	Second branchial cornu	Ceratobranchial II Epibranchial II

In the present work Camp's terminology is used.

In this present discussion our interest, as far as recent reptiles are concerned, is centered upon the Crocodilia since these animals, most closely among the living forms, approach the dinosaurs in their morphological development.

The hyoids of the Crocodilia are described at some length by Fürbringer, who shows that in these reptiles the hyoids consist of a large corpus, ventrally convex, from the side of which project large, well-ossified first ceratobranchials. The corpus is cartilaginous and broader anteriorly than posteriorly. In its dorsal concavity are the cricoid and arytenoid cartilages.

According to Fürbringer, the existence of a ceratohyal is not certain in the Crocodilia. It would seem probable, from the ontogenetic work of Parker, that it was suppressed at an early stage of development.

The first ceratobranchial, says Fürbringer, projects from the lateral border of the corpus and is directed somewhat laterally and somewhat dorsally. This is a very strong, highly ossified element, which often shows, according to the age of the

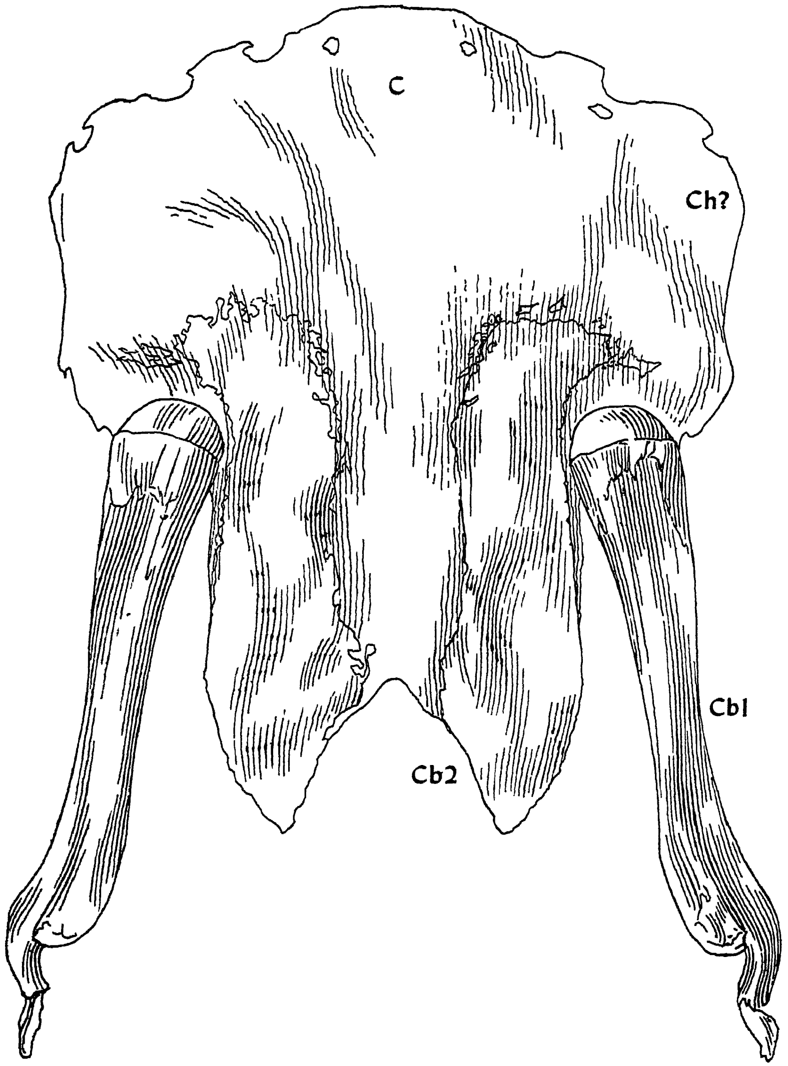

Fig. 2. The hyoid apparatus of *Crocodilus porosus*. Ventral view, natural size. Abbreviations as in figure 1.

animal or the species, a longer or shorter cartilaginous epiphysis at the free end. In young embryos this element is cartilaginous, but it begins to ossify during embryonic life.

The second ceratobranchials are contained in the two posterior corners of the hyoid body or corpus. It might be helpful at this place to supplement briefly Fürbringer's remarks as to the hyoids in the Crocodilia, condensed and paraphrased above, with a few notes regarding the hyoids of *Crocodilus porosus* as shown by a specimen at hand. Evidently this came from a fairly large animal, so that ossification has proceeded to a considerable extent.

The corpus or copula, however, is completely cartilaginous. It is broad, and its lateral edges are extended; these may represent in part at least the ceratohyals, As Fürbringer has shown, this is a debatable question upon the basis of such evidence as is now available to us.

The corpus extends imperceptibly into the second ceratobranchials, which are bony. However, the line of separation between each bony cornu and the cartilaginous body of the copula is not definite, and the two merge into each other. Along the edges the bony cornua are invested by cartilage. The first ceratobranchials protrude from the corpus near the anterior ends of the second ceratobranchials. These first ceratobranchials are completely bony and L-shaped, and their anterior ends, articulating with the corpus, are rounded into "heads." At the angle of the "L" a distinct point is produced. Posteriorly these bones show cartilaginous connections. This specimen is illustrated in figure 2.

With this orientation of the subject in mind, we may now consider the fossil materials that are the basis for this study. Of first importance are the two paired bones that were associated with the *Protoceratops* skeleton, A.M.N.H. No. 6471.

These bones are shown in figure 3, and reference to this illustration will give an idea as to their form to much better advantage than may be had from any word description. These bones are thin and essentially flat, although at their expanded ends they are on one side slightly concave and on the other slightly convex. Each bone is expanded laterally at either end and constricted in the middle, and one side is in the form of a simple, flattened curve, with a somewhat thickened edge. The other edges of the bone are all very thin except at the ends near the juncture of the rounded end surfaces with the simply curved side. Here the edges are thickened.

It is supposed by analogy with the Crocodilia that these flattened bones in *Protoceratops* are the second ceratobranchials. Assuming this to be so, how are these elements to be oriented? This is a difficult question, because unfortunately these bones are shaped somewhat differently from the second ceratobranchials in the Crocodilia.

It would seem most probable, however, that the long, simply curved, and somewhat thickened edge of each bone is the lateral one, and the thin, sinuous curved edge the median one. This would accord with the condition in the Crocodilia, in which the median edges of the second ceratobranchials thin out so that they merge gradually with the cartilage of the corpus. Further support for this orientation of the bones is afforded by the hyoids of *Limnoscelis*, figured by Williston in 1911. Williston found that in *Limnoscelis*, a very primitive Permian cotylosaur, there was a pair of bones which he interpreted as hyoids, and which he described as follows:

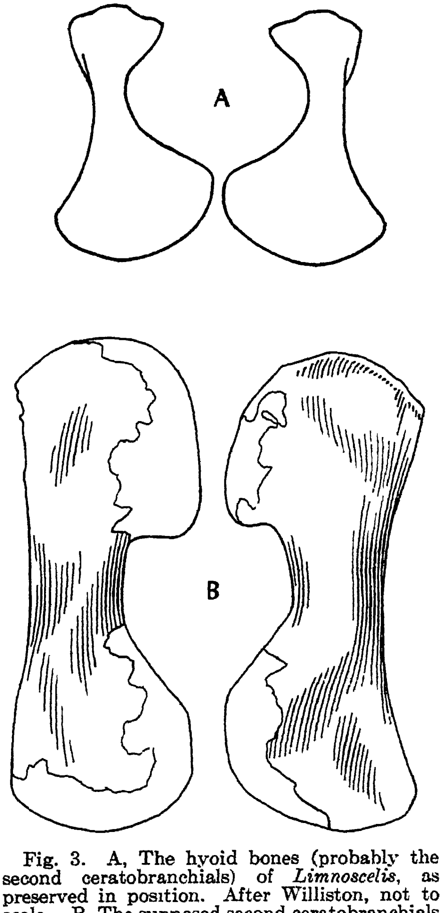

Fig. 3. A, The hyoid bones (probably the second ceratobranchials) of *Limnoscelis*, as preserved in position. After Williston, not to scale. B, The supposed second ceratobranchials of *Protoceratops*. A.M.N.H. No. 6471. Ventral view, natural size. In both drawings the bones are oriented with their assumed anterior ends up.

"In each skeleton there is a pair of bones . . . . of the nature of which I am not fully satisfied, though there would seem to be little doubt but that they are unusually large hyoids. They are . . . . greatly expanded on their distal, thin end, with a somewhat curved and narrowed shaft deeply concave in outline on one side, less so on the other, thickened and truncate for articulation at the proximal end. The two bones in each specimen lie with the thin ends nearly in apposition, as though they had joined each other in life" (Williston, 1911, pp. 36–37).

These bones, which are shown in outline in figure 3, bear a considerable resemblance to the supposed hyoids of *Protoceratops*, as may be seen. Since the hyoids in *Limnoscelis* are in position, with the thin, sinuous edges opposite each other, it is logical to assume that the hyoids in *Protoceratops* were oriented in a similar manner.

As to the question of the anterior and posterior ends of the supposed hyoids in *Protoceratops*, this is a difficult problem to solve. The bones have been oriented as shown in figure 3, with the full realization that further information at some future date may require their reversal, end for end. At any rate, the orientation of the bones as shown seems to correspond most closely with the orientation of the hyoids in *Limnoscelis*, and for the time being this will have to serve as the guide to their position.

Finally, it may be rather safely assumed that the convex surface of each bone in *Protoceratops* is the ventral surface, and that the concave surface faced dorsad, as is the case in the crocodiles.

In addition to these two flat bones, still another small bony fragment of puzzling relationships was found in association with the same *Protoceratops*, namely, A.M.N.H. No. 6471. This is a thin, forked bone, of which it would seem that most of the length of the two forks has been lost. This bone has a sort of small hook or process opposite one of the forks. Here again, a figure gives a much more adequate idea as to the structure of the element than does a word description.

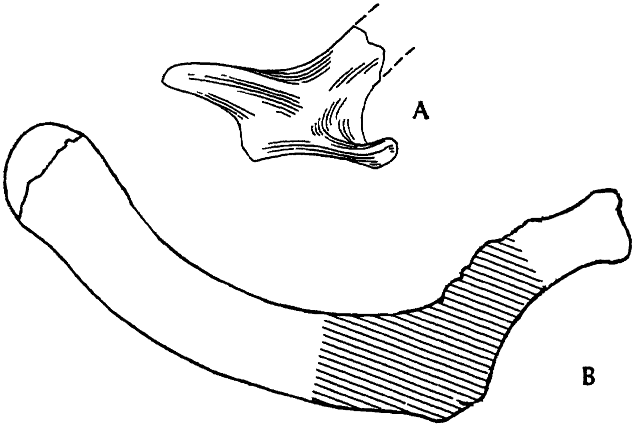

Fig. 4. A, Portion of a bone found in association with *Protoceratops*, A.M.N.H. No. 6471, and identified as possibly a part of the first ceratobranchial. B, Outline of the first ceratobranchial of *Crocodilus porosus*. That portion of the bone supposed to be homologous with the *Protoceratops* bone above (A) is shaded. External lateral views, both natural size.

Frequent attempts to homologize this bone as a portion of a rib have proved to be quite unsatisfactory. Nor is there any other element known in the skeleton of *Protoceratops* with which this bone is closely comparable. Therefore it is suggested that this may be a portion of a first ceratobranchial. In *Crocodilus porosus* the first ceratobranchial, as already mentioned, is an L-shaped bone, with a point developed at the angle of the L. Perhaps this fossil fragment comes from the same general region of the angle in the first ceratobranchial of *Protoceratops* with a possible position as shown in the figure. This may be an erroneous interpretation, but no other satisfactory explanation suggests itself at the present time.

In making this study of the hyoids in *Protoceratops*, a reëxamination of the dinosaur *Psittacosaurus* was made. *Psittacosaurus*, described by Osborn in 1924, comes from the Ondai Sair formation of Mongolia, which makes this form somewhat older than *Protoceratops*. Moreover, there is every reason to think that *Psittacosaurus* is very close to, if not actually on, the ancestral line leading to the Ceratopsia, a point that was made by Gregory in 1927, but that has never received the attention it deserves. Indeed, it is proposed at this place to include *Psittacosaurus* in the suborder Ceratopsia, rather than in the Ornithopoda where it was placed by Osborn, who has been generally followed by subsequent authors.

Despite Osborn's excellent preliminary paper on this genus, *Psittacosaurus* has never been fully described. Consequently many various interesting features characterizing this important little dinosaur are still to be recorded in the literature. In the type skull, A.M.N.H. No. 6254, there is a mass of matrix and bones occupying the space between the rami of the mandible, and because of the information that might be obtained with regard to this question of the hyoids in dinosaurs it was thought expedient to develop this region in the type specimen. The task was undertaken and accomplished by Mr. Falkenbach with his usual skill.

As a result of Mr. Falkenbach's further preparation of the specimen, certain bones came to light that seem without much doubt to be hyoids. These occupy the position in which hyoids might be expected, and they can be eliminated from consideration as cervical ribs because of their shape and size.

They consist of two flattened bones, side by side between the mandibular rami, and two long, rod-like bones. Of the latter, one lies between the two flat bones and in the same plane with them; the other, at right angles to this plane, extends from near the posterior border of the right flat bone to a point beneath the basioccipital of the skull. This latter bone is closely appressed to the cervical vertebrae.

By analogy with the Crocodilia the flat bones are here identified as the flattened second ceratobranchials, while the elongated bones are considered as the first ceratobranchials.

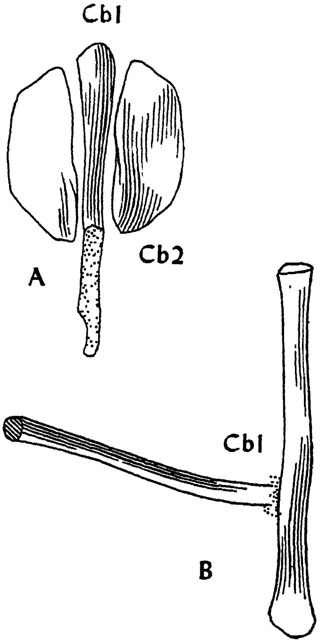

Fig. 5. Hyoid bones in *Psittacosaurus*. A, A.M.N.H. No. 6254. B, A.M.N.H. No. 6534. Ventral views, both figures natural size. Key to abbreviations: Cb1—ceratobranchial I. Cb2—ceratobranchial II.

Strictly speaking, the supposed second ceratobranchials are neither exactly "flat" nor truly bony. Careful examination under the microscope indicates, by reason of the manner in which they are preserved, that these elements were never fully ossified in life but rather were cartilaginous. Therefore these elements may represent the second ceratobranchials and to some extent portions of the corpus, but here a definite conclusion is not possible. They are somewhat convex ventrally, as might be expected, and in each the postero-in-

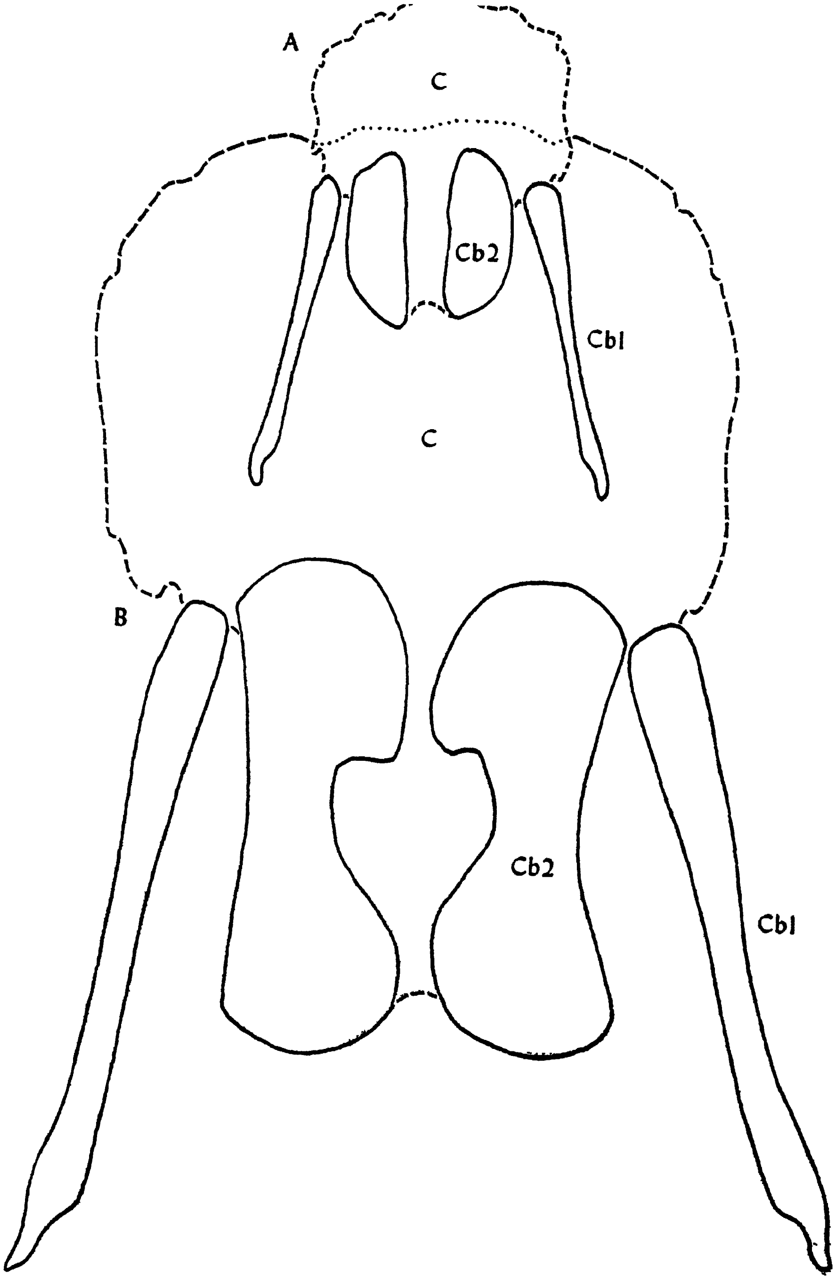

Fig. 6. Restoration of the hyoid apparatus in (A) *Psittacosaurus* and (B) *Protoceratops*. Ventral views, natural size. Key to abbreviations: C—corpus. Cb1—ceratobranchial I. Cb2—ceratobranchial II.

ternal corner is lower than the major portion of the element. It is an interesting fact that a small portion of this postero-internal corner shows a high degree of ossification in just the region where ossification of the second ceratobranchial might be expected. In shape each of these bones has a straight, internal, median edge and a curved, external, lateral edge, and the antero-internal and postero-internal corners are somewhat produced.

The supposed first ceratobranchials are elongated, rod-like bones and are fully ossified, as might be expected. These bones are comparatively straight, and their ends are rounded.

Another specimen of *Psittacosaurus*, A.M.N.H. No. 6534, also shows two loose bones in the basicranial region that are similar in shape to the long bones described above in A.M.N.H. No. 6254 and for this reason are identified as the first ceratobranchials of the hyoid complex. These bones, as exposed in the specimen, are shown in figure 5.

Jaeckel, in his paper of 1913 describing *Plateosaurus*, mentions and figures two large hyoid bones which were found beneath the lower jaws in one of the specimens under his observation. These are very long, rod-like bones, somewhat broadened at their posterior ends. They are obviously homologous with the first ceratobranchials as they are developed in the Crocodilia; indeed this conclusion seemingly was reached by Jaeckel, because he speaks of the "sogenannten Zungenbeinhorner," a term that has been applied to the first ceratobranchials by several German writers.

In this connection it might be pointed out that Gilmore, in 1925, described very briefly some hyoid bones associated with a skull and lower jaws of *Camarasaurus*, in the collections of the Carnegie Museum, Pittsburgh.

"That there is a well developed hyoid apparatus in the Sauropod dinosauria is shown by the preservation in the matrix beneath the lower jaws of three rod-like bones, which undoubtedly represent elements of the hyoid arch. The longest of these measures 165 millimeters in length. Two of them are paired and probably represent the thyrohyal bones" (Gilmore, 1925).

The two long paired bones mentioned by Gilmore are almost certainly the long, bony, first ceratobranchials, the homologues of the thyrohyals in the mammals. What the third bone may be is a debatable question. From Gilmore's figure (pl. 15) this appears to be a rod-like bone, considerably shorter than the paired bones. Perhaps it is a second ceratobranchial.

CONCLUSIONS

From the evidence at hand it would appear that the hyoid bones in the dinosaurs show a development rather similar to that in the modern Crocodilia. In other words, it is probable that in the Saurischia and the Ornithischia the hyoid apparatus took the form of a broad corpus, perhaps for the most part cartilaginous, in the posterior portion of which there were enclosed the paired, flattened, second ceratobranchials. These elements were ossified to a greater or lesser degree. From this broad, plate-like fusion of the corpus and cornua there protruded the long, rod-like, first ceratobranchials. These elements, which were highly ossified and are generally the bones preserved, were attached at one end near the antero-lateral borders of the second ceratobranchials and were directed postero-laterally into the region of the throat. If this picture of the hyoid development in the dinosaurs is correct it is in accord with other morphological characters which show the relationship between these two extinct orders and modern Crocodilia.

In figure 6 the hyoid apparatus is restored in *Psittacosaurus* and in *Protoceratops* on the basis of the known condition in *Crocodilus*.

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NOTES ON *ARCHIMEDES*[1]

By Otto Haas

Within the fauna of the Glen Dean formation of Crane, Martin County, Indiana, bryozoans are by far the dominant group; among them the genus *Archimedes*[2] is probably the most common and certainly the most spectacular, although Condra and Elias (1944, p. 99) list the Glen Dean limestone among the Chester formations in which this genus is not abundant. Ten different forms of *Archimedes* are recognizable in the present material. They will be enumerated in an annotated faunal list of that locality now in preparation. In these notes it is not intended to describe all the forms of *Archimedes* found at Crane, less so since two comprehensive papers dealing explicitly with this genus (McFarlan, 1942; Condra and Elias, 1944) appeared quite recently. Therefore, only a few remarkable specimens are here described. In addition, Condra and Elias' recent bryozoan-algal hypothesis is briefly discussed.

THE FROND OF *ARCHIMEDES TEREBRIFORMIS* ULRICH

McFarlan (1942, p. 443) states the nature of the frond of this species of Ulrich's (1890, p. 575, pl. 63, fig. 5–5c), distinguished by the corkscrew shape of its shaft, to be unknown. Condra and Elias (1944, p. 135, pl. 3, fig. 5, pl. 26, figs. 17–24) were able to study its meshwork in the flange only; these authors also point out that the frond is "usually broken off completely." The material from Crane, however, includes among many specimens of this species four (A.M.N.H. Nos. 26103/3, 26110, 26122, and 26169) in which the frond is more or less well preserved; one of them, A.M.N.H. No. 26122, shown in figure 1, is selected as the hypotype.

In this specimen the frond is seen to attain a diameter of about 35 mm. transversely; where not distorted by crushing, it appears to depart from the axial line at

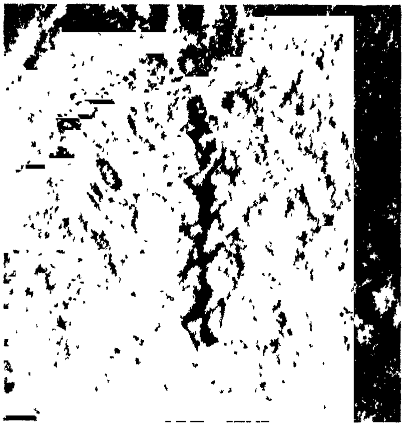

Fig. 1. *Archimedes terebriformis* Ulrich, hypotype, with frond preserved, on specimen A.M.N.H. No. 26122. Glen Dean limestone. Quarry "IIc," Crane, Martin County, Indiana. Natural size. Note frond radiating from screw and portions of meshwork clearly recognizable below screw and at about half the height of the picture to its left and right. The focus having been concentrated on these portions of meshwork, the screw itself is slightly out of focus.

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[1] Second report on the results of the writer's collecting trip to Crane, Indiana, in October, 1944; for the first report see American Museum Novitates no. 1289.

[2] Easton (1943, pp. 142–143; 1944, pp. 406–407) proposes, for nomenclatorial reasons, to replace the generic name *Archimedes* by *Archimedipora*. Condra and Elias (1944, pp. 15–16), however, reject his arguments. Since the solution of this thorny taxonomic problem cannot be attempted in this short article, the universally accepted generic name *Archimedes* is retained here as well as in the forthcoming faunal list. It might, however, be suggested that, should Easton's proposal prove to be supported by the Rules of Nomenclature, the International Commission on Zoological Nomenclature be requested to consider the suspension of the Rules in favor of the retention of the generic name *Archimedes*.

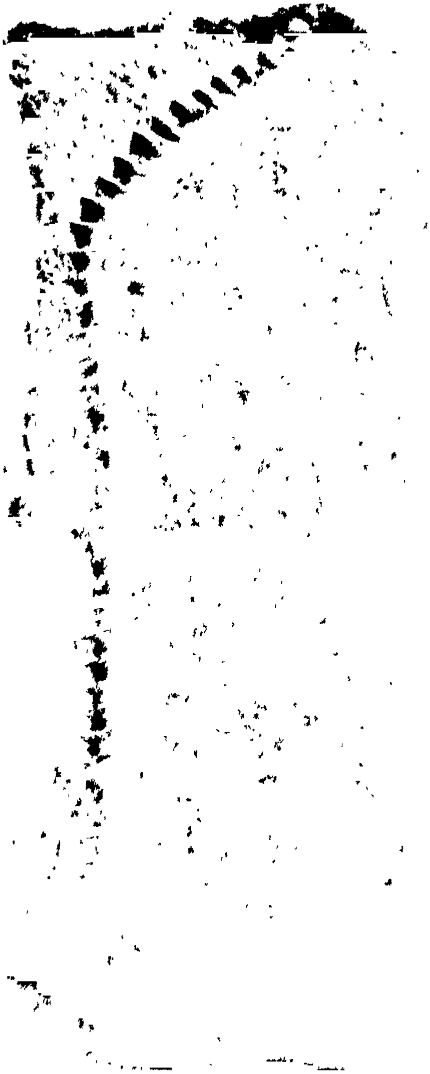

Fig. 2. *Archimedes invaginatus* Ulrich, hypotype, on slab A.M.N.H. No. 26161. Glen Dean limestone. Locality "III," Crane, Martin County, Indiana. × ²/₃.

an angle of 65° (60°–65° given by Ulrich, 1890, p. 575). From five to six branches can be counted on a width of 2.5 mm., and four fenestrules on a length of 2.5 mm.

On the obverse side the fenestrules appear to be only half as wide as the branches and narrow-elliptical in shape; the dissepiments seem, on this side of the frond, only a little narrower than the branches. However, it must be taken into account that these observations were made at a rather short distance from the flange, where the fenestrules are narrowed, and the skeletal elements widened accordingly, by encrustation. The branches are rounded; their middle line is marked by a fine but distinct carina which carries, here and there, equally fine nodes. Their number seems to be inferior to that of the zooecia, from 11 to 12 of which can be counted to a length of 2.5 mm. The latter occupy alternating positions on either side of the keel and are circular or subcircular in shape and provided with slightly raised, thin peristomes.

The reverse side of the frond was studied at a distance of from 4 to 10 mm. from the flange. Here the fenestrules about equal the branches in width and exhibit a subelliptic to oblong shape. The dissepiments are about half as wide as the branches and straight or slightly concave upward. The branches show the fine longitudinal striation frequently observed on the reverse surfaces of *Archimedes* fronds.

Similar observations were made in the study of the frond of the last of the abovementioned specimens of *Archimedes terebriformis*, except that here an unencrusted portion of the obverse side also is accessible to examination, with fenestrules almost as wide as branches, and that there are up to seven branches on a width, and up to five fenestrules and up to 14 zooecia on a length, of 2.5 mm.

But for the facts that the median keel of the branches is fine rather than wide and that its nodes are not very prominent and less rather than more numerous than the zooecia, the microstructural characters described above agree fairly well with those observed by Condra and Elias (1944, pp. 136–137) within the flange only. If the number of nodes is left out of account, the "meshwork formula" of the hypotype from Crane is found to be 20–24/16–20/22–28, as compared to 20–23/15.5–20/20–26 according to Condra and Elias.

HYPOTYPE OF *ARCHIMEDES INVAGINATUS* ULRICH

An unusually large, bent screw of *Archimedes invaginatus* Ulrich (A.M.N.H. No. 26161), selected as the hypotype and illustrated in figure 2, attains, though incomplete, a length, measured along its axis, of approximately 24 cm. and has 46 volutions preserved. It is certainly the largest specimen of this species on record. Of screws referred to other species of *Archimedes*, the largest one of *Archimedes welleri* Condra and Elias, reproduced by these authors (1944, pl. 18, fig. 4a, 4b) from a figure of Keyes' and attaining, according to them (1944, p. 86), 28.5 cm., seems to be the only one which exceeds it in length.

The specimen under discussion is remarkable not only for its extraordinary size but also for its peculiar curvature which, by the way, agrees almost perfectly with that seen in the screw of *Archimedes communis* Ulrich, figured by that author (1890) in plate 63, figure 1. Condra and Elias (1944, p. 38) believe in a "rise [of *Archimedes* helicoids] from a prostrate fenestellid zoarium to an upright position," which caused gradual erection of the screw, as seen in their illustrations, plate 14, figure 3, plate 15, figure 4, and plate 32, figure 6. Curvatures like those observed in the specimen under discussion and in Ulrich's type of *Archimedes communis* mentioned above seem, however, to be essentially different from the initial one discussed and illustrated by Condra and Elias. The former are believed to be smaller or greater deviations of the screw from the vertical direction caused in a later ontogenetic stage by its tendency to compensate for overweight of the frond on one side or the other. Thus the first, only slight deflection of the screw, visible in both Ulrich's type and the specimen from Crane, might be due to a minor disturbance of the equilibrium which was soon overcome, whereas the second, much more decisive and persistent deflection might in both specimens be considered as an attempt toward restoration of equilibrium in the face of a continuous overweight of the frond on one side, or else as a consequence of such overweight on the other which pulled the upper part of the screw down from the upright position. It is believed that despite the buoyancy of the frond in the sea water even slight differences in its development on one side, as compared to the other, which might have been caused by better living and food conditions due to currents, light, etc., must have made themselves felt in the equilibrium of the whole structure which was supported by the comparatively tender screw.

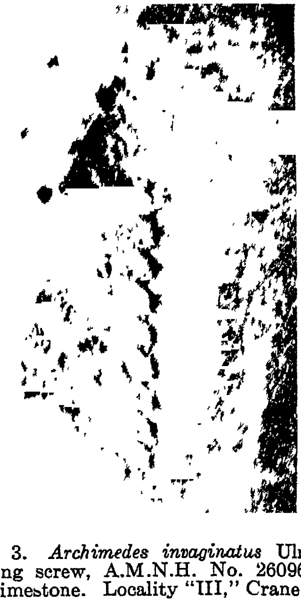

Fig. 3. *Archimedes invaginatus* Ulrich, bifurcating screw, A.M.N.H. No. 26096. Glen Dean limestone. Locality "III," Crane, Martin County, Indiana. Natural size.

BIFURCATING *ARCHIMEDES* SCREWS

Condra and Elias (1944, pp. 34, 65) distinguish, among the *Archimedes* individuals exhibiting more screws than one, adventitious, paired, and twin screws, the first branching off a main screw, the second coiled in opposite directions, the last in the same direction. Many illustrations of all three of these types can be found in their plates. Two examples of paired screws may be found in Ulrich's (1890) plate 63 also (figs. 9b, 14, both specimens refigured by Condra and Elias, 1944, pl. 8, figs. 5, 7).

The present material includes a particularly well-preserved example of "twin screws" of *Archimedes invaginatus* Ulrich, (A.M.N.H. No. 26096), shown in figure 3. Here a screw branches off the main screw at an angle of slightly more than 45°, but soon assumes an upright direction parallel to the main screw which, immediately after bifurcation, deviates slightly in the opposite direction, but soon afterwards resumes its former, upright course. Two features, apparently not yet reported elsewhere, are remarkable. After bifurcation the side screw appears to be in every respect stronger than the "main screw," and the flanges of both neighboring screws remain merged with each other and continuous, as far as preservation permits their study, i.e., for three volutions after bifurcation.

Both these features are observable in another twin screw of *Archimedes invaginatus* Ulrich from Crane (A.M.N.H. No. 26096/5:2), but here only one amalgamated flange is preserved after bifurcation. Here the angle at which the side screw branches off is greater than in specimen No. 26096, attaining about 60°.

CONDRA AND ELIAS' BRYOZOAN-ALGAL CONSORTIUM HYPOTHESIS

Hardly any student dealing nowadays with the genus *Archimedes* is likely to escape taking some position toward the above hypothesis (Condra and Elias, 1944, pp. 1, 25–50). Some observations made in the present material, especially on the structure of the fibrous tissue building up shafts, flanges, and pillars of the screws, on the fibers visible on their surfaces and on the course of these fibers, which sometimes appears indeed to be independent of the main directions prevailing in the meshwork, confirm Condra and Elias' observations. Still, those authors' (1944, p. 25) conclusion "that *Archimedes* is made of *Fenestella* and that the encrusting tissue about it belongs to a different organism in a symbiotic relationship" does not seem to be sufficiently founded on its premises. It is difficult to see why all these structures—in *Archimedes* as well as in other bryozoan genera (see Condra and Elias, 1944, pp. 48–49; 1945)—should not have been built up by the bryozoan colony itself, without any interference from an algal symbiont. This opinion would conform with Ulrich's, who, in a paragraph quoted by Condra and Elias themselves (1944, p. 25), pointed out the essential structural identity of "all the dense portions of the zoarium" in various bryozoa (Ulrich, 1890, p. 353[1]).

Since McFarlan's (1942) and Condra and Elias' (1944) recent papers it can no longer be doubted that bryozoan meshworks, conspecific with each other, are found one time as foliate expansions, without any visible connection with *Archimedes* screws, in which case they have to be called *Fenestrellina*,[2] another time as the fronds of definite *Archimedes* species. This is certainly a most unsatisfactory situation, both biologically and taxonomically, which calls emphatically for some solution of the problem involved. It may, however, still be doubted whether the one suggested by Condra and Elias but questioned by Easton (1944, pp. 407–408) is the correct one.

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[1] Erroneously quoted "53" by Condra and Elias (*loc. cit.*).

[2] Condra and Elias as well as Easton use the generic name *Fenestella*.

1944 [Review of Condra, G. E., and M K. Elias Study and revision of *Archimedes* (Hall).] *Ibid.*, vol. 18, pp 405–409.

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AMERICAN MUSEUM NOVITATES

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STEPHANOLEPIS (*PERVAGOR*) *SEPTEMCLASSIENSIS*, A NEW SPECIES OF ALUTERINE FISH FROM NEW GUINEA

BY OTIS BARTON

While on active duty as a lieutenant in the Naval Reserve, I made a collection of coral reef fishes in Tanamerah Bay in Netherlands New Guinea, which I have subsequently studied at the American Museum of Natural History. The most notable of the species in this collection is an undescribed *Stephanolepis*, which is referable to *Pervagor* as defined by Mr. A. Fraser-Brunner (1941, Ann. Mag. Nat. Hist., ser. 11, vol. 8, p. 183).

Dr. A.·W. Herre, in a letter to me, definitely confirms the convex profile of *S. nigrolineatus*, thus eliminating this species. A comparison of my specimens with a specimen of *Monacanthus tomentosus* (Linnaeus) in the United States National Museum indicates that they are not this species either. It is believed that my specimens, though small, are adults, on account of the long, exserted soft dorsal filaments.

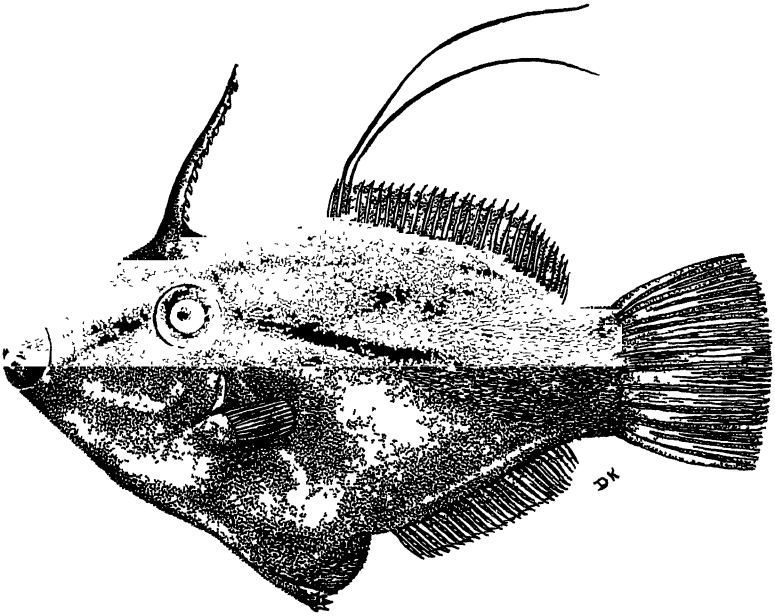

Fig 1. *Stephanolepis* (*Pervagor*) *septemclassiensis*, new species, type, 44 mm. standard length.

DESCRIPTION OF TYPE: A.M.N.H. No. 16520, from Tanamerah Bay, 50 miles west of Hollandia, New Guinea, December, 1944.

Length to base of caudal, 44 mm.; depth from base of soft dorsal to anal in this length, 2.2; depth above ventral spine, 1.7; head, 3.0. Eye in head, 3.0; snout, 1.4; interorbital, 3.0; greatest width of body (behind eyes), 2.1; depth of peduncle, 1.6; its length, 3.2; grand dorsal spine, 1.2; middorsal rays, 3.2; exserted dorsal rays, about 0.8; caudal, 1.6.

Dorsal rays, I-29; anal, 27; pectoral, 11.

Dorsal profile of head concave, ventral profile convex. Oblique gill slit about half of eye, situated almost entirely below posterior half of orbit, and extending at its ventral end close before pectoral base. The grand dorsal spine situated over the middle of the eye; rough on its anterior surface, and carrying 12 downwardly directed spines at each posterior edge. A groove in middle of back behind the spine. Ventral spine ends in a six-pointed star and carries a few points above this star. Ventral flap triangular, not large, its posterior edge in line with end of spine. The second and third rays of the soft dorsal are prolonged in filaments reaching to or beyond end of fin posteriorly. Scales very small and carrying fine ciliate spines, which are larger and recurved posteriorly.

Color in alcohol dark yellowish gray, uniform gray on fins and snout. Indistinct dark dots on sides. Ventral flap dark. Two indistinct, dark, subterminal lines across caudal.

The comparative measurements of the two specimens follow:

LENGTH	DEPTH	HEAD	EYE	DORSAL SPINE	LENGTH D_2
44 mm.	2.2	3.0	3.0	1.2	0.9
38 mm.	2.3	2.9	3.0	1.2	0.9

AMERICAN MUSEUM NOVITATES

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STUDIES OF PERUVIAN BIRDS. NO. L

THE GENERA *RAMPHOCELUS*, *PIRANGA*, *HABIA*, *LANIO*, AND *TACHYPHONUS*

BY JOHN T. ZIMMER

I am greatly indebted to Messrs. James Bond and Rodolphe de Schauensee of the Academy of Natural Sciences of Philadelphia; Dr. Herbert Friedmann of the United States National Museum; Mr. James L. Peters of the Museum of Comparative Zoölogy; Mr. William H. Phelps of Caracas, Venezuela; and Mrs. Ellen T. Smith of the Chicago Natural History Museum for the loan of comparative material used in the present study; also to Mr. Bond and Mr. Phelps for additional information on specimens in their respective collections.

Names of colors are capitalized when direct comparison has been made with Ridgway's "Color standards and color nomenclature."

Ramphocelus carbo carbo (Pallas)

Lanius (*Carbo*) PALLAS, *in* Vroeg, 1764, Cat. Rais. d'Ois., Adumbr., p. 2—Surinam; repository of type unknown.

Tanagra jacapa LINNAEUS, 1766, Syst. Nat., ed. 12, vol. 1, p. 313—based on "The Red-breasted Black-Bird" Edwards; *Lanius carbo* Pallas; and "Jacapu" Marcgrave—Surinam and northeastern Brazil.

Tanagra pompadura P. L. S. MÜLLER, 1776, Natursyst., Suppl., p. 159—based on "Tangara pourpré, de Cayenne" Daubenton, Pl. Enl., pl. 128, fig. 1.

Tanagra albirostris BODDAERT, 1783—based on Daubenton, *tom. cit.*, pl. 128, figs. 1, 2.

Ramphocelus purpureus VIEILLOT, 1822, Tabl. Enc. Meth., Orn., livr. 91, p. 796—new name for *Tanagra jacapa* Linnaeus.

Ramphopis atro-coccineus SWAINSON, 1834, Orn. Drawings, pt. 2, pl. 20—Brazil; type probably in University Mus., Cambridge, England.

Ramphocelus venezuelensis LAFRESNAYE, 1853, Rev. Mag. Zool., ser. 2, vol. 5, p. 243—Venezuela; type from Caracas in Mus. Comp. Zoöl., Cambridge, Mass.

I find it impossible satisfactorily to subdivide the population ranging from the Guianas westward to the Orinoco, northward to northwestern Venezuela, southward to the south bank of the Amazon, and thence westward to northeastern Perú, eastern Ecuador, and southeastern Colombia. Certain features are developed in different parts of the range but they are far from constant and any attempt to segregate subspecific groups on such grounds results in a picture of interrupted distribution that is not very convincing.

Since Surinam is the type locality of *carbo*, the discussion may well start with the birds from that area. Eight adult males from Dutch Guiana are all relatively strongly red in general coloration, with little blackish shading apparent on the middle of the belly and the under tail-coverts. In this respect they are very like northwest-Venezuelan birds which have been separated under the name *venezuelensis*. Some of these Venezuelan birds are brighter than the Dutch Guianan average, and one of two examples from San Cristóbal is bright enough to agree with northeast-Colombian *unicolor*, but others, particularly two from Las Trincheras, Carabobo, are as dark as any Dutch Guianan skin.

Two birds, one sexed as a female and the other without given sex, are unusually brightly colored. Both are strongly reddish on the under parts and have the uropygium between Brazil Red and Nopal Red. At first glance they suggest the females of *Ramphocelus dimidiatus*, but comparison with that form shows them to fall short of the exact coloration of that species. Males from San Cristóbal and the nearby Ortiza are unquestionable *carbo*, although one of the San Cristóbal birds is very close to the subspecies *unicolor* as noted above.

In contrast to the Dutch Guianan series, the males from both French and British Guiana are all relatively dark, and this type of coloration is found predominantly on the lower Orinoco, west to the great bend of the river. On the upper part of the Orinoco, at Nericagua, Perico, and Maipures, there is a recurrence of the brighter coloration, which may be a trend in the direction of *unicolor* although it is a match for "*venezuelensis*" and typical *carbo*.

On the Cassiquiare and the Negro, beginning with the region of Mt. Duida, there is a considerable amount of individual variation. Some of the birds are as bright as "*venezuelensis*" and others, from the same localities, as dark as the British Guianan series, with the darker tone predominant. The same holds true for the birds from Faro, a little east of the lower Negro.

South of the Amazon, from the Xingú west to the lower Madeira, there is close agreement with the Rio Negro (and hence the British Guianan) birds. Farther west, from Teffé to northeastern Perú, a still darker shading begins to appear, while the brighter tones of "*venezuelensis*" and typical *carbo* are quite submerged. A comparison of these birds with "*venezuelensis*" alone or with Dutch Guianan males would seem to demonstrate a good subspecific distinction, but there is no place along the way where satisfactory demarcation takes place.

It is apparent that this darker shading is only a sign of approach to the range of *connectens* with its still darker upper surface and its blackish belly rather sharply defined from the red breast.

East of the Xingú, on the Tocantins and in the Pará district, a similar darkening takes place, showing a trend toward the characters of the dark form, *centralis*, of southeastern Brazil. This southeastern form virtually duplicates the pattern of *connectens*, although the red of the throat in the males is a little deeper than in *connectens* and the females are more strongly reddish in general color, while the size is a little larger. The resemblance, particularly of the males, is, however, striking.

Beyond the Pará district, the intermediate stage continues across Maranhão and northern Piauhy, if the few specimens at hand give an adequate indication. One male from Therezina, Piauhy, is in agreement with numerous examples of *carbo*, and one from Pindahyba, southern Piauhy, is equally comparable to *centralis*, but one from Patos (Gilbúes), quite near Pindahyba, is more strongly reddish and seems close to *carbo*. The Patos bird, furthermore, is larger than the Therezina example, and the Pindahyba specimen is still larger, in agreement with *centralis* also in this respect. Just where the separation of the two subspecies takes place in Piauhy is, therefore, open to question. A series of adult males will be required to establish the probable border, although intergradation no doubt occurs rather broadly.

It thus appears that *carbo* shows a trend toward *unicolor* in the northwestern part of its range, toward *centralis* in the southeastern part, and toward *connectens* in the southwestern part. None of these intermediate stages appears worthy of separate recognition. As a matter of fact, both *centralis* and *connectens* are intermediate between *carbo* and the darkest form of all, *atrosericeus* of Bolivia. The recognition of other intermediate forms is of doubtful value.

In Perú, *carbo* ranges across the northern part of the country on both sides of the Marañón to the region of Moyobamba and Huambo, and ascends the Ucayali part way. A male from "Upper Ucayali" collected by Bartlett probably was secured no farther upstream than Cashiboya, which appears to have been Bartlett's farthest point on that river. This specimen is equivocal for, although it is more strongly reddish on the back and belly than average *connectens*, it is no more so than extreme examples of that form. The red of the throat, however, is darker than in most *connectens* and agrees best with the color of *carbo* to which I refer the bird. A female from Yarina Cocha, a little farther upstream, is indeterminate but may be assigned tentatively to *carbo*.

On the other hand, two males from Pozuzo, although unlike, indicate the presence of *connectens* at that locality. One of the Pozuzo males is rather certainly *connectens* since the back and belly are predominantly sooty, with only a trace of red coloration, and there is sharp definition between the belly and the red breast which, in turn, is the brighter red of *connectens* rather than the darker tone of *carbo*. The other Pozuzo bird has a more noticeable red suffusion on the upper and under parts and suggests *carbo* in that particular, but the throat is the bright hue of the first Pozuzo skin. A series of specimens from near the mouth of the Urubamba River is predominantly like *connectens*, although there is an occasional development of reddish color on the upper and lower under parts, not sufficient to approach *carbo* very closely.

On the upper part of the Huallaga River, the situation is extremely puzzling. I have no males of the *carbo* group from that region, and the females at hand present a problem that involves the relationship of *carbo* to *melanogaster*.

Females of *melanogaster* are separable from those of *carbo* and its conspecies by one character that appears to be constant and one that is less definitive though useful. The uropygium of female *melanogaster* and its conspecies *transitus* reflects the brilliant red coloration of the male sex in a Pompeian Red × Nopal Red hue. The females of the *carbo* group have the uropygium much duller and usually browner although it sometimes reaches a bright Garnet Brown in color. The brightest female of the *carbo* group is noticeably darker and duller, in this respect, than any affine of *carbo*. By this character, therefore, it appears easy to distinguish the females of the two species.

The second character is that of the presence of a relatively bright reddish tinge on the feathers of the forehead, chin, and sides of the head. Most females of *melanogaster* and *transitus* exhibit this feature, but it varies in degree of development and is sometimes poorly marked. On the other hand, it is found in occasional females of the *carbo* group. It is not, therefore, perfectly distinctive.

The identity of the birds from the middle Huallaga must be investigated with these facts in mind. There is little constancy to be seen in their characteristics. Two males from the Huayabamba Valley, 5500 feet, are unquestionably *carbo*, although the red of the throat is somewhat brighter than in other north-Peruvian specimens and resembles the color of that area in *connectens*. A female from the same valley but lower, 3800 feet, is a fairly bright *carbo* with noticeable reddish suffusion on the anterior portion of the head. Two males from "Supuna" [=Lopuna], at the mouth of the Río Huayabamba, in the Munich Museum and Paris Museum, respectively, belong to the *melanogaster* group according to Hellmayr (1936, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 9, p. 261, footnote)—one typical *melanogaster* and the other nearer *transitus*.

From farther up the Huallaga Valley, a supposed female at hand from Pizana is like the Huayabamba female in general color, although the rufous facial area is paler and more extensive. A presumed female from Nuevo Loreto is very similar.

A male from Pizana, in the Munich Museum, is said by Hellmayr to be like *melanogaster* on the under parts, although with a little broader black on the middle of the belly, but more like *carbo* on the upper parts, although with some bright red tips or margins on the tail-coverts and rump.

A male from Tocache, in the same general region, is *transitus* without a trace of *carbo*, but Hellmayr records a male from the same locality, in the Paris Museum, that is like *carbo* except for the presence of a few bright red feathers on the under tail-coverts and flanks and a band of the same bright color on the lower rump. A female from Tocache, in the Munich Museum, is said to be *melanogaster* (*transitus*). A female in the Paris Museum from "Perou, N. -E." (which Hellmayr specifies as from Piña) is mentioned by Berlioz (1933, L'Oiseau, new ser., vol. 3, p. 594) as indistinguishable from a female of *carbo centralis* from Goyaz, Brazil, and is apparently, therefore, unlike the females of the *melanogaster* group to which Berlioz refers it.

Thus, in the region of the middle Huallaga, from the Huayabamba Valley to Tocache, only one female—from Tocache—appears to be referable to the *melanogaster* group while four females are closest to *carbo*. In the same area, two males from the upper Huayabamba Valley are certainly *carbo;* two from Lopuna belong to the *melanogaster* group; one from Pizana is a mixture of *carbo* and *melanogaster;* and of two from Tocache, one is *transitus* and the other is nearest *carbo* with traces of *melanogaster* coloration.

I am somewhat suspicious of the value of the red feathers on the rump and tail-coverts as an indication of admixture of *melanogaster* with *carbo*. There are at hand several males of various subspecies of *carbo* that indicate another possibility. These birds are in what appears to be a retarded adult plumage, perhaps the first winter plumage, with numerous fresh feathers showing decided traces of the preceding immature colors. The upper tail-coverts, in particular, are largely black with bright tips that are a brighter red than the color found in that area in the young birds of either sex or in adult females. There are specimens of this sort from Trinidad (*carbo magnirostris*), northeastern Venezuela (*capitalis*), Matto Grosso, Brazil (*connectens*), and from the Guianas to the Ucayali, Perú (*carbo*). One male of *capitalis* from San Félix, Cumaná, Venezuela, is in almost complete adult male plumage with a band of dull reddish color across the lower rump. There can be no question of intergradation with *melanogaster* or *dimidiatus* at these respective localities. Consequently, a similar condition prevailing on the Huallaga may be due to the same sort of individual variation.

There appears to be no conflict in the ranges of *carbo*, *melanogaster*, and *dimidiatus* except along this portion of the Huallaga in northern Perú, and there, as shown in the preceding paragraphs, either intergradation or specific hybridization occurs. Possibly the proper concept would be that of a single specific group for all three "species" since they are of undoubtedly common origin and still retain many characters in common, particularly in the female sex. The great similarity between *dimidiatus* and *melanogaster* would then fall into proper perspective. However, until more can be determined regarding the situation on the Río Huallaga, it may be best to retain the three groups as specifically distinct while recognizing their close affinity.

Obviously a good series from the Huallaga must be obtained before the problem can be settled satisfactorily. Until such time arrives, it seems advisable to record the known specimens from that region as one species or the other, respectively, or as apparent hybrids.

Records that I assign to *T. c. carbo* are from Bellavista, Huambo, Corral, Piña, Yurimaguas, Tarapoto, Chayavitas, Iquitos, and Pebas, as well as those from certain of the localities from which material has been examined in this connection. There is a record from "Moyobamba" cited by Taczanowski from the Raimondi Collection, but there is no other evidence that *carbo* occurs at that locality, in spite of extensive collecting that has been done there by other workers. The record needs confirmation.

Ramphocelus carbo connectens
Berlepsch and Stolzmann

Rhamphocelus jacapa connectens Berlepsch and Stolzmann, 1896, Proc. Zool. Soc. London, p. 344—La Merced, Chanchamayo, Perú; type in Berlepsch Collection, Frankfort Mus.

This form is confined, so far as known, to southeastern Perú, from near the Bolivian border to the mouth of the Río Urubamba and the upper tributaries of the Río Pachitea. There is little individual variation in this area, although occasional males show a more definite reddish tone on the back and posterior under parts than the rest of the population. The red of the throat is somewhat lighter in tone than that of most *carbo*. Females tend to be noticeably darker brown on the back than those of *carbo*. I have seen no examples of this sex that show any approach toward the sooty female plumage of *atrosericeus*, although that form occurs just across the territorial boundary of Bolivia, but the darker and browner back of *connectens*, in comparison to that of *carbo*, is, in itself, an approach toward the Bolivian form.

The rump and upper tail-coverts of the females are sometimes only a little brighter and more rufous than the mantle, although there is always a certain amount of brighter color in that area. The face as often as not has a tinge of red, and in some instances it is very bright. One female in very worn plumage, from Astillero, has the chin and auriculars Coral Red, the forehead tinged with the same color, and the whole back of the head white, with some faint brownish tips. Several other skins show a tendency in the same direction, although the red hue is not so bright and the white of the occiput is concealed by broader brown tips on the feathers. Still other females have no concealed whitish areas on the occipital feathering, although the chin, anterior auriculars, and forehead are definitely dull reddish. These characters should be noted in connection with the discussion of the middle Huallaga population of *carbo*, given under that form.

Records of *connectens* are from the following localities other than those from which material has been examined: Maranura, Potrero, Huiro, Chaquimayo, Río Comberciato, San Gaban, Carabaya, Monterico, Chirimayo, Huaynapata, San Pedro, Escopal, Pangoa, and Chanchamayo.

Ramphocelus melanogaster melanogaster (Swainson)

Rhamphopis melanogaster Swainson, 1837 (Dec. 31), Anim. in Menag., p. 359—Perú (Moyobamba suggested by Zimmer, 1929); [♂]; W. Hooker Collection, possibly in Liverpool Mus., England.

Rhamphocelus Luciani Lafresnaye, 1838 (Apr.), Rev. Zool., vol. 1, p. 54—no locality (=northern Perú); ♂; Mus. Comp. Zoöl., Cambridge, Mass.

I have given elsewhere (1929, Proc. Biol. Soc. Washington, vol. 42, p. 98) an account of the identity of *melanogaster* and "*luciani*," and in the discussion of *R. carbo carbo* on an earlier page of the present publication, I have discussed the complications with respect to the meeting of that species and *melanogaster* on the middle Huallaga. A few points may be repeated here.

The females of *melanogaster* usually have a certain restricted area on the forehead, sides of the head, and upper throat tinged with red, but some examples do not, and, on the other hand, some females of *carbo* show the same character. The principal distinction between the two species in female plumage is, then, the brilliance of the color on the rump and upper tail-coverts, and in this regard I have seen no certain intermediacy. Males, of course, are quite distinct, although the difference is, in last analysis, that of intensity or brilliance of the red coloration on the posterior upper and under parts.

Without a series of birds from the middle Huallaga, it is impossible to define the boundary between the typical subspecies and the form found on the upper Huallaga. The only male at hand from the middle part of the river is *transitus*, and of two males from Lopuna, Hellmayr found one approaching *transitus* and the other like *melanogaster*. The two forms thus appear to meet somewhere near the mouth of the Río Huayabamba. Until series are available for additional study, the Lopuna birds may be placed with those from Rioja and Moyobamba in *m. melanogaster*. There are no other records.

Ramphocelus melanogaster transitus Zimmer

Rhamphocelus melanogaster transitus Zimmer, 1929 (Mar. 25), Proc. Biol. Soc. Washington, vol. 42, p. 95—Chinchao, Dept. Huánuco, Perú; ♂; Chicago Nat. Hist. Mus.

The redder mantle and the brighter red coloration of the throat, less sharply defined from the lower breast than in *melanogaster*, are shown by an adult male from Tocache, indicating that *transitus* ranges at least that far down the Huallaga. Two females of this genus from the same general region, but not the exact locality, belong to *R. c. carbo* and not to *m. transitus* as might have been expected.

As noted in the discussion of *carbo carbo*, I am uncertain as to the advisability of uniting this species with *R. dimidiatus*. There is a marked similarity in general coloration between the two "species," and *transitus*, by its redder mantle, tends to stand between *m. melanogaster* and *d. dimidiatus*. The females of both groups are very similar, although *dimidiatus* rarely has even a weak development of reddish color on the anterior part of the head, while the uropygium is a lighter hue of red and, as in the male sex, a little more broadly extended anteriad than in *melano-*

There is a broad hiatus between the ranges of the two groups that is filled by *c. carbo* and *c. unicolor* so that the three groups replace each other everywhere except possibly on the Río Huallaga. If it is eventually found that *melanogaster* and *carbo* are true intergrading forms of a single species, it is probable that *dimidiatus* will be advantageously placed in the same relationship.

SPECIMENS EXAMINED

- *R. c. carbo.*—
  - FRENCH GUIANA:
    - (Cayenne, Roche Marie, Approuague, and Isle Le Père), 12 ♂, 5 ♀.
  - DUTCH GUIANA:
    - (Albina, and near Paramaribo), 9 ♂, 5 ♀.
  - BRITISH GUIANA:
    - (Wismar, Minnehaha Creek, Tumatumari, Kamakusa, Rockstone, Potaro Landing, and "Demerara"), 21 ♂, 10 ♀, 2 (?).
  - VENEZUELA:
    - (Paulo, Arabupu, Auyan-tepui, Maipures, Nericagua, Maripa, Suapure, Munduapo, Perico, Barrancas, "Upper Orinoco," Ayacucho, La Unión, La Vuelta, La Prisión, mouth of Chanaro River, Caicara, Boca de Sina, mouth of Río Ocamo, opposite mouth of Ocamo, Esmeralda, Mt. Duida—Caño Seco, Caño León, Playa del Río Base, Campamento del Medio, Savana Grande, La Laja, Cassiquiare—Solano, Buena Vista, El Merey, opposite El Merey, junction of Cassiquiare and Río Huaynia, Caracas, Las Trincheras, Valencia, Puerto La Cruz, San Estéban, San Cristóbal, Ortiza, Duaca, and Aricagua), 72 ♂, 33 ♀, 5 (?).
  - BRAZIL:
    - Rio Uaupés (Iauarete and Tahuapunto), 8 ♂, 2 ♀;
    - Rio Negro (Tatú, San Gabriel, Yucabí, Tabocal, Santa Maria, Cucuhy, Uacará, Cravoeira, Camanaos, Tauapessasu, Igarapé Cacao Pereira, Muirapinimá, and Manaos), 83 ♂, 61 ♀ 2 (?);
    - Faro, 11 ♂, 8 ♀;
    - Rio Branco, Caracarahy, 1 ♀;
    - Colonio de Veado, near Obidos, 1 ♀;
    - Piauhy (Therezina and Rio Taguarasú), 2 ♂, 1 ♀;
    - Maranhão (Anil, As Mangueras, Taboca, and Ilha São Luis), 11 ♂, 5 ♀, 1 (?);
    - Pará (Pará, Utinga, Prata, Benevides, Igarapé Assú, Bemfica, and Ananindeua), 9 ♂, 2 ♀;
    - Rio Tocantins (Baião and Mocajuba), 7 ♂, 3 ♀;
    - Rio Xingú (Tapará, Porto de Moz, and Victoria), 6 ♂, 4 ♀, 1 (?);
    - Rio Tapajoz (Tauarý, Santarem, Aramanaý, Igarapé Amorín, and Piquiatuba), 8 ♂, 7 ♀, 6 (?);
    - Villa Bella Imperatríz (Santa Clara, Lago Andirá, and Boca de Andirá), 9 ♂, 3 ♀, 1 (?);
    - Rio Madeira (Calamá, Porto Velho, Borba, Igarapé Auará, Rosarinho, and Santo Antonio de Guajará), 49 ♂, 23 ♀;
    - Rio Preto, Santa Isabel, 2 ♀;
    - Rio Roosevelt, São João, 1 ♂;
    - Teffé, 15 ♂, 7 ♀.
  - ECUADOR:
    - (Macas region, Zamora, Coca, Napo, Ambato, Archidona, San José, and Río Suno), 17 ♂, 9 ♀, 2 (?).
  - COLOMBIA:
    - (Loretoyacu, La Morelia, Florencia, and above Florencia), 7 ♂, 5 ♀.
  - PERÚ:
    - Mouth of Río Curaray, 9 ♂, 2 ♀;
    - Puerto Indiana, 14 ♂, 6 ♀;
    - Río Mázan, 1 ♂;
    - Nauta, 1 ♀;
    - Jeberos, 1 ♂, 2 ♀;
    - Jaen, 3 ♂, 1 (?);
    - Huarandosa, 1 ♂, 1 ♀;
    - Perico, 3 ♂, 3 ♀;
    - San Ignacio, 1 ♂, 1 ♀;
    - Charapi, 1 ♂;
    - Río Chinchipe, 1 ♂, 1 ♀;
    - Huayabamba [Valley], 2 ♂, 1 ♀;
    - Nuevo Loreto, 1 [♀];
    - Pizana, 1 [♀];
    - Sarayacu, 8 ♂, 1 ♀;
    - Yarina Cocha, 1 ♀;
    - "Upper Ucayali" [=near Cashiboya], 1 ♂.
- *R. c. connectens.*—
  - PERÚ:
    - Pozuzo, 2 ♂;
    - Chuchurras, 1 ♂, 1 ♀;
    - Puerto Bermúdez, 1 ♂[1];
    - Río Colorado, 1 ♂[1], 2 ♀[1];
    - San Ramón, 1 ♂[1];
    - La Merced, 4 ♂, 1 ♀;
    - Perené, 2 ♂, 3 ♀, 3 ♂[2], 1 ♀[2];
    - Utcuyacu, 1 ♂;
    - Tulumayo, 6 ♂, 4 ♀;
    - Huacapistana, 1 ♀[2];
    - Eneñas, 1 ♂[2];

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[1] Specimens in Chicago Museum of Natural History.

[2] Specimens in Academy of Natural Sciences of Philadelphia.

    - San Juan, 1 ♂[1];
    - Province of Junín, 1 ♂;
    - Urubamba, 1 ♂[2];
    - Idma, 2 ♂, 1 ♀;
    - Santa Ana, 1 ♀;
    - mouth of Río Urubamba, 1 ♂, 1 ♀;
    - Santa Rosa, Ucayali, 15 ♂, 4 ♀;
    - Candamo, 1 ♂, 2 ♀;
    - Río Inambari, 2 ♂;
    - Río Tavara, 5 ♂, 3 ♀;
    - Astillero, 1 ♂, 3 ♀;
    - Cosñipata, 2 ♂, 2 ♀, 1 ♂[1];
    - La Pampa, 1 ♀[1];
    - La Oroya, Inambari, 2 ♂[1], 2 ♀[1].
- *R. c. atrosericeus.*—
  - BOLIVIA:
    - (Mapiri, Pitiguaya, Río Guanai, Río Chimate, Yungas of Cochabamba, Locotal, Mission San Antonio, Todos Santos, Espirito Santo, San Mateo, mouth of Río San Antonio, Tres Arroyos, Province of Sara, and "Bolivia"), 32 ♂, 22 ♀, 5 (?).
- *R. c. centralis.*—
  - BRAZIL:
    - Chapada, 40 ♂, 25 ♀, 8 (?);
    - Matto Grosso (Barão Melgaço, Tapirapoan, Palmiras, Urucum, Descalvados, San Lorenzo River, Siete de Setembro, Juruena, S. Juan Ranch, Cuyubá River, Utiarity, Campanario, and Campos Novos), 22 ♂, 8 ♀;
    - São Paulo (Franca and Fazenda Cayoá), 2 ♂;
    - Minas Geraës, Rio Jordão, 1 ♂, 1 ♀;
    - Piauhy (Pindahyba and Patos), 2 ♂, 1 ♀;
    - Bahia, Santa Ritta, 1 ♂;
    - Goyaz (Fazenda Esperança and Rio Araguaya), 3 ♂, 2 ♀, 2 (?).
- *R. c. unicolor.*—
  - COLOMBIA:
    - Villavicencio, 2 ♂, 1 ♀;
    - Buena Vista, 4 ♂, 2 ♀;
    - Mambito, 3 ♂, 1 ♀;
    - "Bogotá," 7 ♂, 1 [♀].
- *R. c. capitalis.*—
  - VENEZUELA:
    - (El Pilar, Sacupana, Guanoco, Cuchivano, Cristóbal Colón, Guanaguana, Cumanacoa, Rincón San Antonio, San Félix, and "N. E. Venezuela"), 14 ♂, 10 ♀.
- *R. c. magnirostris.*—
  - TRINIDAD:
    - (Princestown, Caparo, Carenage, Chaguaramas, Pointe Gourde, Laventille, Valencia, Savannah Grande, Caspare, Seelet, and "Trinidad"), 38 ♂, 37 ♀, 3 (?).
- *R. m. melanogaster.*—
  - PERÚ:
    - Moyobamba, 7 ♂[2], 4 ♀[2], 2 ♂[1], 2 ♀[1];
    - Río Seco, 5 ♂, 2 ♀;
    - Rioja, 1 ♀[2];
    - "Cartagena," (*errore*), 1 [♂][3] (type of "*Luciani*");
    - "Upper" [= lower] Huallaga, 1 ♂[4];
    - "Headwaters of Huallaga" [= lower Huallaga], 1 ♂[4].
- *R. m. transitus.*—
  - PERÚ:
    - Chinchao, 1 ♂[2] (type);
    - Vista Alegre, 3 ♂[2], 2 ♀[2];
    - Tocache, 1 ♂.

[*Ramphocelus icteronotus* Bonaparte was credited to "central Peru" by Ridgway (1902, Bull. U. S. Natl. Mus., vol. 50, pt. 2, p. 114), presumably on the basis of an early record by Taczanowski (1887, Proc. Zool. Soc. London, p. 332) which is quoted by Ridgway. Taczanowski's record, however, is from Palmal, Ecuador, and although this locality is quite near the Peruvian boundary, it is on the Ecuadorian side. Consequently, although the species may possibly range into extreme northern Perú, there is no existing record at the present time.]

Piranga rubra rubra (Linnaeus)

[*Fringilla*] *rubra* LINNAEUS, 1758, Syst. Nat., ed. 10, vol. 1, p. 181—based on "The Summer Red-Bird" Catesby, Hist. Nat. Carolina, vol. 1, p. 56, pl. 56—"Carolina and Virginia" = South Carolina.

Tanagra misisippica HERMANN, 1783, Tabl. Aff. Anim., p. 214—based on "Tangara, du Mississippi" Daubenton, Pl. Enl., pl. 741.

Tanagra coccinea BODDAERT, 1783, Tabl. Pl. Enl., p. 46—based on "Tangara, du Mississippi" Daubenton.

[*Loxia*] *virginica* GMELIN, 1789, Syst. Nat., vol. 1, pt. 2, p. 849—based on "Yellow-bellied Grosbeak" Pennant, Arctic Zool., vol. 2, p. 351, and Latham, Gen. Synop. Birds, vol. 2, pt. 1, p. 125; Virginia.

[*Tanagra*] *mississippensis* GMELIN, 1789, Syst. Nat., vol. 1, pt. 2, p. 889—based largely on "Tangara, du Mississippi" Daubenton.

[*Tanagra*] *aestiva* GMELIN, 1789, Syst. Nat., vol. 1, pt. 2, p. 889—based on "The Summer Red-Bird" Catesby.

[*Tanagra*] *variegata* LATHAM, 1790, Ind. Orn., vol. 1, p. 421—based on *Tanagra mississippensis* Gmelin, *Loxia virginica* Gmelin, and "Variegated Tanager" Latham.

? *Pyranga livida* SWAINSON, 1827, Phil. Mag., new ser., vol. 1, p. 438—Real del Monte, Hidalgo, Mexico; W. Bullock Coll.

Chaupe, 4 ♂; Uchco, 1 ♂; Perené, 1 ♂.

This migrant from the United States is

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[1] Specimens in Academy of Natural Sciences of Philadelphia.

[2] Specimens in Chicago Natural History Museum.

[3] Specimen in Museum of Comparative Zoölogy, Cambridge.

[4] Specimens in United States National Museum.

found in winter over much of northern South America, as far south as western Bolivia and the Rio Madeira, Brazil. Other Peruvian records are from "Headwaters of Huallaga River" (? near head of navigation, lower Huallaga); Tambillo, Nuevo Loreto, Chinchao, Huachipa, Río Colorado (Chanchamayo), and Idma. The Academy of Natural Sciences of Philadelphia has specimens from Moyobamba and San Juan de Perené.

The reference to *Pyranga livida* Swainson has been included universally in the synonymy of *rubra* rather than in that of *cooperi*, although there is no positive evidence that this is correct. Swainson's original description gives the length of the tail as $3^1/_2$ [inches] which is longer than in either *rubra* or the western subspecies but nearer the latter. The type locality, in the State of Hidalgo, Mexico, is in that part of the country where *rubra* has been found but not *cooperi*, and it is probable that the assignment of the name *livida* to the synonymy of *rubra* is quite correct. Since the type has disappeared, the matter is not susceptible to exact determination.

Piranga flava lutea (Lesson)

Pithylus luteus Lesson, 1834, l'Inst., vol. 2, no. 72, p. 317—Callao, Perú; ♀; repository of type unknown.

Piranga testacea tschudii Berlepsch and Stolzmann, 1892, Proc. Zool. Soc. London, p. 375—Lima; ♂, ♀; cotypes in Warsaw Mus.

Huacho, 2 ♂; Poroto, 2 ♂; Paletillas, 3 ♂; Virú, 1 ♂, 3 ♀; Cabico, 2 ♂; Taulis, 2 ♂, 1 ♀; Seques, 2 ♂, 1 ♀; Palambla, 4 ♂, 3 ♀; Huancabamba, 4 ♂; Jaen, 2 ♂, 1 ♀; Lomo Santo, 2 ♂; Sondorillo, 1 ♂, 1 ♀; Perico, 2 ♂, 1 ♀; El Tambo, 1 ♀; Cajabamba, 1 ♂, 1 ♀; Succha, 2 ♂; Viña, 2 ♂, 1 ♀; Chusgon, 2 ♀; Choquisongo, 1 ♂; Chanchamayo, 1 ♂, 1 ♀; Chauillay, 1 ♂, 2 ♀; Río Huacamayo, 1 ♀.

Largely confined to the Subtropical Zone of Perú, western Ecuador, and northwestern Bolivia, but descending into the arid coastal region from near Lima northward. I have little to add to my earlier discussion of this form (1929, Field Mus. Nat. Hist., zool. ser., vol. 17, pp. 191–195). Various specimens in the series listed above show that the annual molt occurs largely in April and May. April birds are in quite worn plumage with a suggestion of beginning molt. May and June birds at hand are in fresh plumage with the last vestiges of molt on the wings and tail, and one or two July specimens also show the end of the plumage change. One young male, dated August 12, is still in molt from immature olive and yellow to orange-red.

A male and female from Milagros must now be credited to Ecuador, if my allocation of that locality is correct.

There are records of *lutea* from Santa Eulalia, Callao, Lima, Lurin, Surco, Lechugal, Huayabamba [Valley], Chirimoto, Callacate, Tambillo, Tabaconas, near Nancho, Chinchao, Vista Alegre, Cullcui, Hacienda Limón, Junin, La Merced, Santa Ana, Huaynapata, Río Comberciato, and Marcapata, and the following localities are further represented in the collections of the Academy of Natural Sciences of Philadelphia: Porculla, Río Chinchipe, Utcubamba, Huarmey, Suchiman, La Laja, Perené, Patás, Chagual, Chira, and Soquian.

Piranga olivacea (Gmelin)

Tanagra rubra (not *Fringilla rubra* Linnaeus) Linnaeus, 1766, Syst. Nat., ed. 12, vol. 1, p. 314—based on "Le Cardinal de Canada" Brisson, Orn., vol. 3, p. 48, pl. 2, fig. 5; Canada.

Tanagra olivacea Gmelin, 1789, Syst. Nat., vol. 1, pt. 2, p. 889—based chiefly on "Olive Tanager" Latham, Gen. Synop. Birds, vol. 2, p. 218, and Pennant, Arctic Zool., vol. 2, p. 369; [Hempstead, Long Island], New York.

Pyranga erythromelas Vieillot, 1819, Nouv. Dict. Hist. Nat., nouv. éd., vol. 28, p. 293, pl. M. 22, fig. 1—based on *Tanagra rubra* (Latham, *ex*) Linnaeus.

Chanchamayo, 1 ♂; mouth of Río Curaray, 1 ♂.

This species is a more uncommon visitor to Perú than its congener, *P. rubra*.

There is only one additional record, a specimen taken by Jelski at Monterico and recorded by Taczanowski (1874, Proc. Zool. Soc. London, p. 514). Curiously, Taczanowski omitted any reference to the species in his "Ornithologie du Pérou."

Piranga rubriceps G. R. Gray

Pyranga rubriceps G. R. GRAY, 1844, Gen. Birds, vol. 2, p. 364, pl. 89, lower fig.—no locality (Bogotá-skin in British Mus.).

Piranga rubriceps rufistigmata LÖNNBERG AND RENDAHL, 1922, Ark. Zool., vol. 14, no. 25, p. 86—above Baeza, eastern Ecuador; Stockholm Mus.

San Pedro, 1 ♂, 1 ♀; La Lejia, 5 ♂, 1 ♀.

I can find no differences in birds from Ecuador and Colombia and those from northern Perú. Other Peruvian records are from Cutervo and Cumpang, while Chira is to be added from the collection of the Academy of Natural Sciences of Philadelphia.

Habia rubica peruviana
(Taczanowski)

Phoenicothraupis peruvianus TACZANOWSKI, 1884, Orn. Pérou, vol. 2, p. 498—Yurimaguas, Monterico, Chayavitas, and Chamicuros, Perú; restricted to Yurimaguas by Berlepsch, 1910.

Phoenicothraupis rubica amabilis BERLEPSCH, 1907, Ornis, vol. 14, p. 348—San Mateo, Bolivia; ♂; Frankfort Mus.

The plumages and molts of this species are difficult to understand owing to considerable variability and some apparent irregularity in the succession of the earlier stages. Young birds of both sexes appear to be warmer brown above than the adult females and have the wings also warmer brown and the under parts relatively more brownish. Some of the young birds, sexed as males, are passing from this dress into a much more olive one, although occasionally an example shows the incipient acquisition of a certain amount of adult male red color in what appears to be the same post-juvenal molt. Most of the nearly adult males that show the final stages of molt into adult red plumage, however, are losing the last traces of olive, rather than brown, feathering.

The tail is decidedly reddish in young birds of both sexes, although not the clearer red of the adult males, and this, too, is changed in the post-juvenal molt to olive, changing to full red in the males and going again to olive in the females at the succeeding molt. Whether this succeeding molt is the first prenuptial or a post-nuptial one I have been unable to determine exactly. One male with enlarged gonads has the tail and wings (except for olive tertials) strongly reddish brown, the throat quite yellowish, and the crest yellow, while the back is largely olive with some admixture of warm brown, though with no signs of molt. This would indicate that the bird had already acquired its first breeding plumage which combined some of the features of the juvenal and some of the adult female plumages, with the addition of a brighter yellow throat and crest than is shown by adult females.

There may be some reversion before adults reach a stable plumage. I have one male of *rubra* from Venezuela that is obviously going back from red to olive in a general molt. Various other examples of this and other subspecies show traces of similar backward renewals but with the new greenish feathers so irregularly spaced as to give rise to the suspicion that they are adventitious replacements of accidental loss (see Zimmer, 1929, Field Mus. Nat. Hist., zool. ser., vol. 17, no. 5, p. 176, for the account of a similar condition in *Piranga flava*), but the molt of the Venezuelan specimen mentioned above is too extensive for this interpretation. Other specimens from the same season (May-June) show normal post-juvenal and supposedly prenuptial molt, including an adult male replacing red with red. A study of the species in the aviary should prove highly instructive.

The relative instability of the pigmentation of some of the younger examples of this species is shown by another young male of *rubra* from northeastern Venezuela which has the terminal third of the tail noticeably olivaceous and the rest of the tail strongly reddish.

There is some confusion in the matter of type locality for *peruviana*. In the original description of this form, Taczanowski listed specimens from Chayavitas, Chamicuros, Yurimaguas, and Monterico without designating any one of them as type locality or specifying a type. The following year (1885, Ibis, p. 272), Sclater discusses a male from Monterico sent to him by Taczanowski as "the typical specimen," but many years later (1927, Ann. Zool. Mus.

Polonici Hist. Nat., vol. 6, p. 186), Sztolcman and Domaniewski list a male from Yurimaguas as the type. That there is some basis for this contention is indicated in Taczanowski's original account where he compares the form to several others and adds the comment that the Monterico specimens differ from the Yurimaguas birds. Berlepsch (1912, Berlin V. Internatl. Ornith.-Kongr., p. 1070) accepted the selection of a Yurimaguas bird in the Warsaw Museum as type and thus virtually restricted the type locality to that place, a procedure which I follow here.

I am very doubful of the advisability of separating the Bolivian *amabilis* from the Peruvian population, excepting the birds from extreme northeastern Perú which will be discussed further. There are various specimens of both sexes in the Bolivian and Peruvian series that can be matched with each other. The adult males are equally dark and gray on the lower under parts, the throats are very similar in depth and actual hue, the upper parts vary to much the same extent, and the mandible is relatively dark throughout the combined series. The females usually have a decided ochraceous coloration on the under parts and a moderately warm tone of brown above, and, although certain examples are decidedly paler beneath, the flanks are relatively strongly brown and the throat and belly are not whitish as in *hesterna* of the lower Amazon but have a certain buffy tone that is obvious on comparison with typical *hesterna*. Such light-colored examples are at hand from Bolivia, the upper Ucayali in Perú, and near the mouth of the Huallaga, also in Perú.

There is no place in this combined series where any positive distinction occurs, and it seems undesirable to establish an arbitrary line of separation for which so many exceptions would be required.

At the lower end of the Amazon, a definite distinction is immediately apparent for which the name *hesterna* was supplied by Griscom and Greenway (1937, Bull. Mus. Comp. Zoöl., vol. 81, no. 2, p. 437), based on birds from Pataua, right bank of the Rio Tapajoz. It is not evident, from the material before me, that this subspecies is replaced on the left bank of the Tapajoz and, at least for some distance, westward by *peruviana* as claimed by the authors of *hesterna*. As a matter of fact, I am unable to separate any part of the Amazonian population as far west as the Rio Madeira for, although there is only an occasional relatively dark bird from east of the Tapajoz, there are light birds from west of it that cannot be distinguished from the east-bank specimens. Together, the series shows a fairly uniform distinction from *peruviana* and if a single line of demarcation must be made, it should be well to the westward of the Tapajoz.

The characters of *hesterna* comprise, in the adult males, a much paler under surface than in *peruviana*, with the throat and under tail-coverts pink, the belly very pale pinkish, and the flanks pale grayish with a slight brownish tinge. The females are lighter than those of *peruviana*, both above and below, with the dorsal surface more olivaceous, less warm, brown and the under parts extensively whitish, with a slight amount of ochraceous or buffy color on the breast in some examples. There is no solidly ochraceous or brownish coloration as in *peruviana*.

For a certain distance west of the Rio Madeira, the females have the characters of *hesterna* and could be assigned to that form with little hesitation. Males, on the other hand, show a gradually increasing depth of pigmentation that prevents such positive identification. Nevertheless, I find a closer approximation to *hesterna* than to *peruviana* at least as far as Teffé which is the most western locality from which I have adult males. Of four birds of this sex from that locality, none is so pale as the Tapajoz examples of *hesterna* but none is so dark as *peruviana*, and three specimens from the lower left bank of the Madeira are intermediate between the Teffé birds and the Tapajoz skins. It is difficult to suggest the proper assignment of these birds either to one or the other form and, since they are so intermediate in character, it seems inadvisable to propose a new subspecies for their inclusion, especially since the females show such approximation to the full characters of one of the described forms.

One male, the only one from Rosarinho, stands out from the entire series by the unusually bright red (near Coral Red) throat which is, however, nearer the Coral Red × Jasper Red of some other examples of *hesterna* than to the Brazil Red of *peruviana.*

For the present, therefore, I refer all these middle-Amazonian birds to *hesterna* with a full realization that they are, at best, intermediate between that form and *peruviana.*

Peruvian records of *peruviana* are from Chayavitas and Monterico as well as from some of the localities from which material has been examined in the present study.

Habia rubica rhodinolaema
(Salvin and Godman)

Phoenicothraupis rhodinolaema SALVIN AND GODMAN, 1883, Biol. Cent. Amer., Aves, vol. 1, p. 300, footnote—Sarayacu, Ecuador; ♂, ♀; cotypes in British Mus.

The characters of this form are not too positive but the few specimens at hand from extreme northeastern Ecuador are just distinguishable from *peruviana* (noticeably different from *hesterna*) and may be taken to represent this subspecies.

The original description makes no mention of *peruviana* or of any other South American form but, after a Latin description, says merely that it is "A small species differing in many respects from all hitherto described. The female is peculiar in its light-colored underparts." Consequently, later authors must be consulted for comparative notes on the typical specimens. Hellmayr appears to be the only person who has reported on the original pair from Sarayacu. He says (1907, Novit. Zool., vol. 14, p. 44) that the male differs from *peruviana* by having the throat and crest of a much brighter, more scarlet red; the dusky margins of the crest rather better defined; female not distinguishable from that of *peruviana.* However, he included in *peruviana* the lower Amazonian population which is quite distinct, as noted above in the discussion of *peruviana.*

In a later account (1936, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 9, p. 304) he comments briefly on a restriction of the red gular area in the male. The east-Ecuadorian males now before me show no such character. The gular area is very slightly lighter in tone than it is in *peruviana* males and the dorsum in one specimen is darker red than that of most *peruviana* while the crown-patch has somewhat more obvious dusky lateral borders than in all but a few Peruvian and Bolivian specimens. The females, however, show a little differentiation. Whereas the upper parts in *peruviana* are relatively warm brown or a moderately light olive brown, the same region in the Ecuadorian females is darker and without much warm tone. The under parts are paler than in most *peruviana* females and in none of the specimens are they as noticeably ochraceous as in the average Peruvian or Bolivian bird, nor so whitish as in *hesterna.*

Two females from northeastern Perú, north of the Amazon, presumably belong here. Their upper parts are not quite so dark as in the darkest Ecuadorian bird and the under parts are even paler and more whitish, approaching *hesterna* in that respect, but *hesterna* females have the back still lighter olivaceous brown. It is possible, because of the paleness of the under parts in these two birds, that they are more like the female cotype of *rhodinolaema* than the Ecuadorian females at hand.

Two males from the Rio Uaupés, Brazil, likewise appear to belong to *rhodinolaema.* They agree with the Ecuadorian males in most respects and, although they have the belly a little paler, about as in Teffé skins of *hesterna,* the throat is more scarlet than rosy red and the sides of the crown, in one of the two skins, is noticeably dusky. Additional specimens may show distinctions that are not apparent with this limited material, but for the present I must refer the Uaupés birds to *rhodinolaema.*

SPECIMENS EXAMINED

H. r. rubra.—
  TRINIDAD:
    (Valencia, Savannah Grande, Laventilla, Caparo, Chaguaramas, and Princestown), 15 ♂, 2 ♀.
  VENEZUELA:
    Cristóbal Colón, 8 ♂, 1 ♀, 1 (?);
    Campos Alegre Valley, 1 ♂;
    Quebrada Seca, 4 ♂, 4 ♀;

Cumanacoa, 1 ♂;
Río Neveri, 3 ♂.
H. r. coccinea.—
VENEZUELA:
La Azulita, Mérida, 1 ♂.
H. r. rhodinolaema.—
BRAZIL:
Rio Uaupés, Tahuapunto, 2 ♂.
ECUADOR:
Río Suno, above Avila, 2 ♂, 1 ♀;
lower Río Suno, 1 ♂, 3 ♀.
PERÚ:
Mouth of Río Curaray, 1 ♀;
Apayacu, 1 ♀.
H. r. peruviana.—
PERÚ:
Río Negro, west of Moyobamba, 1 ♂, 1 ♀;
Yurimaguas, 1 ♂, 1 ♀;
Chamicuros, 2 ♂;
Jeberos, 1 ♀;
"Peruvian Amazons," 1 ♀;
La Merced, 1 ♂, 1 ♀;
Lagarto, 3 ♂, 1 ♀;
Santa Rosa, 1 ♂;
Puerto Bermúdez, 2 ♂[1], 1 ♀[1].
BOLIVIA:
La Paz region, 1 (?);
Todos Santos, 2 ♂, 1 ♀;
Mission San Antonio, 10 ♂, 4 ♀;
mouth of Río San Antonio, 2 ♂, 1 ♀;
San Mateo, 1 ♂, 1 ♀;
Juntas, 1 ♂;
Río Chimoré, 1 ♂;
Province Sara, 1 ♂, 1 (?).
H. r. hesterna.—
BRAZIL:
Rio Xingú, Tapará, 3 ♂;
Rio Tapajoz, Boim, 1 ♂;
Caxiricatuba, 1 ♂, 1 ♀;
Santarem, 6 ♂, 2 ♀;
Igarapé Brabo, 4 ♂, 6 ♀;
Villa Braga, 1 ♀;
Rio Jamauchim, Tucunaré, 1 ♂;
Villa Bella Imperatríz, 13 ♂, 6 ♀;
Rio Madeira, Borba, 1 ♂;
Igarapé Auará, 4 ♂, 1 ♀;
Humaythá, 2 ♂, 1 ♀;
Calamá, 1 ♂, 2 ♀;
Rosarinho, 2 ♂;
Teffé, 4 ♂, 5 ♀.

Lanio fulvus peruvianus Carriker

Lanio atricapillus peruvianus CARRIKER, 1934, Proc. Acad. Nat. Sci. Philadelphia, vol. 86, p. 331—Moyobamba, Perú; ♂; Acad. Nat. Sci., Philadelphia.

A series of 64 specimens of this species from various parts of its range shows that the suggested characters of *peruvianus* are not perfectly constant. In fact, if the form is to be recognized, it must include all the birds from Ecuador and Colombia in distinction from those of the Guianas, Venezuela, and northern Brazil. In this area, the adult males have the back averaging lighter and more uniformly yellow, sometimes with the upper tail-coverts also yellow at the tips, although not so dark as in true *fulvus fulvus*. Owing to the lighter color of the back as a whole, the yellow collar is less in contrast to the lower part of the mantle. An occasional specimen has the back about as dark as in some *fulvus fulvus*, but in these the collar, also, is relatively dark. The under parts are, on average, but little lighter than in *fulvus fulvus* and often no different.

The females are puzzling but the difficulty may lie in the differences due to age and the sex of immature birds. In both *fulvus* and *peruvianus* there are some birds that are strongly brownish over the whole under parts and others that have a distinct greenish tinge on the breast. Some obviously immature examples as well as probable adults are in both color groups. Any attempt at segregation on this basis is quite unsatisfactory.

Except for the type record from Moyobamba, there are no Peruvian records of the species.

SPECIMENS EXAMINED

L. f. fulvus.—
FRENCH GUIANA:
"Cayenne," 4 ♂;
Ipousin River, Approuague, 1 ♀.
DUTCH GUIANA:
"Interior," 1 ♀.
BRITISH GUIANA:
Ourumee, 1 ♂;
River Carimang, 1 ♂;
"interior," 1 ♂.
VENEZUELA:
Mt. Auyan-tepui, 7 ♂, 3 ♀, 1 (?);
Mt. Duida, Caño Seco, 1 ♂, 1 ♀.
BRAZIL:
Faro, 2 ♂, 2 ♀;
São Antonio de Cachoeira, Rio Jary, 1 ♂, 1 ♀.
L. f. peruvianus.—
COLOMBIA:
"Bogotá," 6 ♂, 1 ♀.
ECUADOR:
Río Suno, above Avila, 2 ♂, 3 ♀;
lower Río Suno, 1 ♂;
below San José de Sumaco, 1 ♂, 1 ♀;
Macas region, 1 ♂;
"Napo," 1 ♂;
Sarayacu, 1 ♂;

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[1] Specimens in Chicago Natural History Museum.

Zamora, 2 ♂;
Sabanilla, 1 ♂;
Ecuador, 1 ♂.
PERÚ:
Apayacu, 1 ♂;
mouth of Río Curaray, 1 ♂, 1 ♀;
Pomará, 1 ♂, 1 ♀;
Río Negro, west of Moyobamba, 2 ♂;
Río Seco, 1 ♂.

Lanio versicolor versicolor
(D'Orbigny and Lafresnaye)

T[achyphonus] versicolor D'ORBIGNY AND LAFRESNAYE, 1837, Mag. Zool., vol. 7, cl. 2, "Syn. Av.," p. 28—Yuracares (rep. Boliviana); cotypes in Paris Mus.

Peruvian birds of this species are best referable to the Bolivian form although, judging by the limited Bolivian material at hand, they reach a greater extreme of size than Bolivian specimens.

On the other hand, the birds from Matto Grosso and the upper Rio Madeira region of Brazil, assigned by authors to *v. versicolor*, may be better placed in *parvus*, the small subspecies described from the Rio Jamauchim, an affluent of the Tapajoz. The measurements of the birds from the four areas, as shown by the series before me, are as follows:

		WING	TAIL
♂	Perú	82–89 mm.	66–75.5
	Bolivia	80.5–87	68–72.5
	c. Brazil	77–81.5	65–69
	Tapajoz	77–80	66–69
♀	Perú	75–82.5	64–70.5
	Bolivia	75.5	64
	c. Brazil	73–76.5	60.5–65.5
	Tapajoz	72–72.5	59–63.5

There is little difference in coloration of the males throughout the specific range, and nothing that is accurately diagnostic. Males of *versicolor* have a little more pronounced subterminal blackish bar on the lower mantle feathers than those of *parvus*, at least as an average condition, but it is far from constant. They also have the yellow area on the top of the head more frequently extended posteriad over the occiput, but this is too variable to be of much service. The females of *versicolor* have browner or more ochraceous brown, less olive or olive brown, throat, breast, and flanks, and darker under tail-coverts, than those of *parvus*, and in this respect the central Brazilian examples are readily placed with *parvus* rather than *versicolor*.

A single male from Teffé, Brazil, agrees with Peruvian birds (wing, 83 mm.; tail, 70.5). One specimen in the series is labeled "Moore Napo" but the locality is certainly in error. It may have come from the south bank of the Amazon opposite the mouth of the Napo near Orosa from which locality I have two specimens. There is no evidence that the species crosses the Amazon at any place. Its range complements that of its congener, *L. fulvus*, quite exactly, although there is a region in northwestern Brazil from which no member of the genus is yet known.

Peruvian records of *versicolor* are from San Gaban, Chaquimayo, Cosñipata, Monterico and Río Javarí (Brazil?).

Taczanowski (1884, Orn. Pérou, vol. 2, pp. 500–501) cites also "Ucayali supérieur, Santa Cruz (Bartlett)," but this citation is open to suspicion. Sclater (1873, Proc. Zool. Soc. London, pp. 252–311) gives a condensed account of all of Bartlett's Peruvian collections with additions from other sources, and on page 262, *Lanio versicolor* is accredited only to Bates from the Río Javarí. *Eucometis penicillata* is recorded from the upper Ucayali and Santa Cruz from Bartlett's material, and it is likely that Taczanowski repeated this citation for *Lanio versicolor*. In any case, while the record from the upper Ucayali (in Bartlett's case this means near Cashiboya) is plausible, owing to other Ucayali records, that from Santa Cruz, on the lower Huallaga, is less so although not impossible.

SPECIMENS EXAMINED

L. v. versicolor.—
PERÚ:
Orosa, 1 ♂;
Lagarto, 1 ♂;
Huachipa, 3 ♂[1], 1 ♀[1];
?"Napo," 1 ♂;
Pozuzo, 1 ♂, 1 ♀;
Chuchurras, 1 ♂;
Astillero, 3 ♂, 2 ♀;
Marcapata, 1 ♂;
Candamo, 1 ♂;
La Pampa, 2 ♂, 2 ♀;
Río Tavara, 1 ♂.

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[1] Specimens in the Chicago Natural History Museum.

BOLIVIA:
  Mission San Antonio, Río Chimoré, 1 ♂;
  mouth of Río San Antonio, 1 ♂, 2 ♀;
  lower Beni, 1 ♀.
BRAZIL:
  Teffé, 1 ♂.
L. v. parvus.—
BRAZIL:
  Matto Grosso, Monte Cristo, 1 ♂, 1 ♀;
  Rio Roosevelt, Camp 8, 1 ♂, 2 ♀;
  mouth of Rio Cherrie, 1 ♀;
  Rio Madeira, Humaythá, 1 ♂;
  Alliança, 1 ♂;
  Rio Jamauchim, Santa Elena, 1 ♀;
  Rio Tapajoz, Caxiricatuba, 3 ♂;
  Tauarý, 1 ♂, 1 ♀.

Tachyphonus rufus (Boddaert)

Tangara rufa BODDAERT, 1783 (Dec.), Tabl. Pl. Enl., p. 44—based on Daubenton, Pl. Enl., pl. 711—♀; Cayenne.

Oriolus melaleucus SPARRMAN, 1787, Mus. Carlson., fasc. 2, pl. 31—Surinam; ♂.

Oriolus leucopterus GMELIN, 1788, Syst. Nat., vol. 1, pt. 1, p. 392—based on Latham, Gen. Synop. Birds, vol. 1, pt. 2, p. 440—Cayenne; ♂.

Tanagra nigerrima GMELIN, 1789, Syst. Nat., vol. 1, pt. 2, p. 899—based on Daubenton, *op. cit.*, pl. 179, fig. 2 (♂), and pl. 711 (♀).

Tachyphonus cirrhomelas VIEILLOT, 1819, Nouv. Dict. Hist. Nat., nouv. éd., vol. 32, p. 357—based on Desmarest, Hist. Nat. Tangaras, livr. 9, pl. 49 (young ♂); Guiana.

Tachyphonus beauperthuyi BONAPARTE, 1851, Compt. Rend. Acad. Nat. Sci. Paris, vol. 32, p. 82—no locality; cotypes in Paris Mus. from "Côte ferme" near Cumaná, Venezuela.

Tachyphonus rufus subulirostris PINTO, 1935, Rev. Mus. Paulista, vol. 19, p. 268 (in text)—Bomfin, northeastern Bahia, Brazil; cotypes in Mus. Paulista.

Santa Ana, 2 ♂; Río Seco (near Moyobamba), 2 ♂; Perico, 5 ♂, 1 ♀; Jaen, 4 ♂, 2 ♀; Uchco, 1 ♂; Huayabamba [Valley], 2 ♂, 2 ♀.

This wide-ranging species appears not to have broken up into any recognizable subspecies. There are certain individual variations in size, in the exact quality of the metallic sheen of the males and the tone of rufous in the females, and even in the occasional presence of a rufous coronal patch in the males, but none of these features shows any geographical correlations.

In spite of the broad area occupied by the species, there are some areas where it has never been taken but where it might reasonably be expected to occur. Its absence from the extensive collections made in these areas is surprising but may sometime be explained when adequate field studies are made. Thus, while the bird occurs in Colombia as far south as Ricaurte and in northern Perú on the Río Chinchipe, it has never been taken in Ecuador. It appears to be absent from central Perú but reappears in the Urubamba Valley. It has not been taken in Bolivia but occurs in Matto Grosso, Brazil, in Paraguay and northern Argentina, and through eastern Brazil from São Paulo northward to the Pará district and west along the southern bank of the Amazon to the Rio Tapajoz, but the whole Amazon Valley above that tributary, including both sides of the main stream, the whole course of the Rio Negro, and the far western tributaries, the Río Ucayali and the Río Napo, have no records of the bird. It reappears again in the three Guianas, on the middle Orinoco, on Trinidad and Tobago and in northern Venezuela, rather widely in central and southern Colombia, and again in western Panamá and eastern Costa Rica. Such distribution is difficult to explain.

Peruvian records, other than those from localities listed above, are from Maranura, Huiro, Potrero, Pintobamba, Idma, Moyobamba, Bellavista, Chirimoto, Huambo, and Corral (eggs only).

[**Tachyphonus valeryi**
(J. and E. Verreaux)

Pyrrota valeryi J. AND E. VERREAUX, 1855, Rev. Mag. Zool., ser. 2, vol. 7, p. 351—"l'Amérique centrale," *errore;* type and paratype in Paris Mus. are labeled "Pebas, Haut Amazone."

There has been considerable mystery surrounding this bird. Sclater (1856, Proc. Zool. Soc. London, vol. 24, p. 114) places "*valerii*" in the genus *Tachyphonus* (of which *Pyrrota* is a synonym) without having seen the original material or any specimens he could refer to it, and later (1886, Cat. Birds Brit. Mus., vol. 11, p. 207) puts it in the synonymy of "*melaleucus*" (= *T. rufus*) in spite of its black under wing-coverts and black shoulder which he had noted in the earlier citation. Extensive material has been collected in the Pebas region in recent years without the discovery of any *Tachyphonus* or generic affine with the characters of *valeryi*, but no critical study of the type and paratype was ever made to confirm Sclater's assignment to *Tachyphonus*.

Mr. James Bond (*in litt.*) suggested to me the possibility that the species was not a tanager at all, but possibly the troupial, *Lampropsar tanagrinus*. I have made a careful examination of a good series of that bird and find myself in perfect accord with Mr. Bond's suggestion. Measurements are in excellent agreement, the general resemblance to *Tachyphonus* is notable, and the locality, Pebas, is well within the range of *Lampropsar*. Pending a critical study of this troupial, *Pyrrota valeryi* may thus be withdrawn from the Thraupidae and placed as a synonym of *Lampropsar tanagrinus tanagrinus* (Spix).]

Tachyphonus cristatus (Linnaeus)

Tanagra cristata LINNAEUS, 1766, Syst. Nat., ed. 12, vol. 1, p. 317—based on "Le Tangara noir hupé de Cayenne" Brisson, Orn., vol. 6, Suppl., p. 65, pl. 4, fig. 3 (adult ♂); Cayenne; Madame de Bandeville Coll.

The identification of Peruvian specimens of this species has led to an examination of all the described subspecies, the arrangement of which has not been entirely satisfactory. The nominate form from Cayenne ranges southward to the Amazon in the neighborhood of Faro and Obidos, gaining a little increase in reddish tinge of the crest of the males in the more southern localities, but retaining a maximum length of tail (69–73 mm. in males) and moderate length of crest (long occipital feathers, 10.5–13 mm.) with well-developed post-frontal band of buff, carried along the sides of the head. The females are relatively dull in color but have a little brown on the cap, while the forehead is light buffy. Females from Faro are like French Guianan examples.

The yellow-crowned *intercedens* of Dutch and British Guiana (and the Orinoco Delta) occupies a limited range in the area mentioned. Four birds from Mt. Auyan-tepui have been referred by the writer and Mr. Phelps (1945, Amer. Mus. Novitates, no. 1274, p. 8) to this form, although some discussion of them should be added. The males might readily be assigned to *c. cristatus* (in spite of the interposed *intercedens*) but the other two birds, neither of which is fully adult, although nearly so, disagree with the females and young of that form and agree exactly with those of *intercedens* in their olive coloration above, with no brown coronal patch, and the particular hue of Yellow Ocher on the under parts. The strong orange color on the crests of the males certainly is not typical of *intercedens*. It is quite possible that the Auyan-tepui birds should be separated as new, but this action may better await larger series with fully adult females. In the meantime, the nearest geographical representative, with which the two young birds quite agree, is *intercedens*.

On the middle Orinoco and Caura rivers, *orinocensis* occurs, with the male crest more reddish than that of *cristatus* and with the females more warmly colored above, with a stronger and darker brown crown and a distinctly gray, instead of dull buffy, front. The tail averages a little shorter than in *cristatus* (63–71 mm. in the males) and the male crest a little shorter (9–12 mm.).

In the vicinity of Mt. Duida and southeast through the Cassiquiare region and the course of the Rio Negro in Brazil, the males have the most pronounced red on the crest of any of the forms found north of the Amazon, with the maximum development of the frontal band, and the females have the lower under parts most strongly and deeply colored (Mars Yellow × Xanthine Orange in full-plumaged examples). They agree with "Bogotá-skins" and thus should be referred to *cristatellus*, described from "Bogotá" examples. One male from Loretoyacu, Colombia (formerly in Perú) and one from Apayacu, Perú, east of the mouth of the Napo, agree with the remainder of this series and indicate the southwestern extension of range of *cristatellus*.

Some of the females from the Duida-Negro series are very like those of *orinocensis* in the color of the under parts, but most of them are in worn and, presumably, faded plumage from which much of the brilliant orange-ochraceous color has been lost. Even in these few examples, the coronal patch is usually deeper rufescent brown than in fresher *orinocensis* examples, enabling their being recognized as *cristatellus*.

Some adult males have the crest no deeper red than those of *orinocensis*, which occasionally matches the deeper color of *cristatellus*, but the series are quite recognizably distinct.

In view of the assignment of other Duida birds to *cristatellus*, I have transferred the record of *orinocensis* from the western foot of Duida (Zimmer and Phelps, 1945, Amer. Mus. Novitates, no. 1274, p. 8) to *cristatellus*. It is an immature male and not certainly determinable as to subspecies.

Some south-Venezuelan and north-Brazilian females show the throat quite pale and the breast tinged with grayish, in considerable contrast to the deeply colored belly, but others from the same localities are only a little lighter ochraceous on the same area. These more uniform birds agree with the few "Bogotá" females at hand, although those at the other extreme are noticeably distinct as indicated. The resemblance in general richness of coloration is such that I am unwilling to suggest any separation on the basis of the extreme examples.

While all the forms from north of the Amazon have the gular patch in the males more restricted than do those from south of the river (with the exception of *nattereri* which may belong to this species, as discussed below), some of the specimens of *cristatellus* are the most marked in this respect of all that I have seen. One male from Mt. Duida, for example, has only a trace of bright color on the tips of a few feathers and some others have but little more. The measurements of male *cristatellus* may be given as: wing, 75.5–81 mm.; tail, 62–71; long occipital feathers, 9.5–13.

Specimens from eastern Ecuador and northeastern Perú, on both sides of the Amazon but not east of the mouth of the Napo, are quite different from *cristatellus* and, in the male sex, show considerable resemblance to *cristatus*. They have shorter tails, however, and the buff frontal band is less prominent in the males while the females are darker above, somewhat more intensely colored below (on average), and have the forehead gray as in *cristatellus*. In view of the interposition of *cristatellus* over a wide terrain between the Napo and the range of *cristatus*, these birds appear to deserve separation; their description is given below.

Near the Río Chinchipe, in northwestern Perú, though east of the Andes, the long-crested *huarandosae* has its limited range. Some examples of the Napo form approach it in the length of crest, but *huarandosae* represents the extreme limit of variation in that geographical direction. The color of the crest is about that of *cristatus* at its lighter limits. Females of this form are not yet described.

South of the Amazon in Brazil, all the males have the general body color less deeply black than in the various forms mentioned above, with a duller, somewhat more brownish tone. This is shown by fresh examples from the various regions and is not due to any post-mortem change in the specimens. In extreme eastern Brazil, the relatively long-crested *brunneus* ranges from São Paulo at least as far north as Pernambuco. I have not seen Maranhão examples which may also belong to this subspecies. The crest is not only long (the long occipital feathers measure 13 to 18 mm.) but very full and moderately deeply colored, like the lighter individuals of *cristatellus*, with the buff frontal band moderate in extent and not marked on the sides of the crown. Males have the wing, 70.5–82 mm.; tail, 68–75.

From the Pará district westward to Teffé, there is a graduated progression of stages in variation that is difficult to define. In the environs of Pará and on the Tocantins, all the adult males at hand demonstrate a paler gular patch than that which exists in true *brunneus* and, in addition, some of them have the crest more deeply red than the same area in *cristatellus* —much redder than the crest of *brunneus*. The long occipital feathers of the male are 11 to 15 mm. in length; wing, 79–84.6; tail, 67–75.

From the Xingú west to Teffé and up the

Madeira, the color of the male throat perceptibly deepens. The deepest color is found in examples from the Madeira, but specimens from the Xingú and the Tapajoz often agree with the lighter Madeiran examples, although there is an occasional suggestion of the pale extreme of the Pará and Tocantins birds. Some specimens of *brunneus* also agree with the lighter Madeiran birds in the color of the throat. The crest is the deepest red, on average, of any of the forms of the species, although *cristatellus* and the Pará population occasionally show a close approach. The crest is relatively short in the males—11–15 mm.; the wing and tail are long, 77.5–86.5 and 65–76, respectively. This entire population belongs to *madeirae*. The population of Pará and the Tocantins, however, although it agrees with *madeirae* in dimensions and approaches it in the color of the crown, shows an extreme character of unusually pale throat that sets it sufficiently apart to warrant its separate recognition. It is described and named below.

It is observable that the males of *brunneus* sometimes have the whole area of the under wing-coverts white and never seem to have the carpal margin wholly blackish, although there may be a blackish patch or stripe at the base of the primaries, extending submarginally anteriad. On the other hand, males of *madeirae* frequently have the whole bend of the wing blackish, although sometimes there is a certain amount of white on the carpal margin, always separated from the white inner coverts by the dusky submarginal stripe. The Pará form resembles *madeirae* in this respect.

Females of *madeirae* average somewhat lighter in color than those of *brunneus*, with a tendency toward greater contrast between the more deeply colored feathering along the carpal margin and the lighter color of the inner under wing-coverts. The distinction is not constant.

It may be stated that the line between *madeirae* and the Pará form is not sharply drawn since there is complete intergradation. When birds from Pará and the Tocantins are compared with others from the Madeira, the distinction is pronounced. Because it is possible to match some Xingú and some Madeira specimens, I prefer to include the Xingú series in *madeirae*.

The question of the reputedly specifically distinct *nattereri* from Matto Grosso cannot be answered with the material at hand. The male is said to be smaller than *cristatus* (wing, 73 mm.; tail, 64), with a more orange crest, more restricted uropygial patch, and no light gular area. The female is still smaller (wing, 71) and more rufous below and on the rump than the same sex of *cristatus*. These differences are not convincing as specific characters. As noted under *cristatellus*, some males of that subspecies have almost no gular patch, and the tail is sometimes only 62 mm. in length, although I have seen no male with its wing less than 75.5, not much longer than that of *nattereri*. I seriously question the assignment of a female from Salto do Girão to *nattereri*. The locality is but a few miles from Calamá, and the description and measurements of the specimen agree well with certain examples of *madeirae*. Pelzeln, the author of *nattereri*, was himself in doubt of the association of the male from Villa Maria and this female.

In any case, I am confident that *nattereri* can be at best no more than a subspecies of *cristatus* to which Pelzeln compared it.

The citations of the Peruvian forms, with the descriptions of the new subspecies, follow.

Tachyphonus cristatus huarandosae Chapman

Tachyphonus cristatus huarandosae Chapman, 1925 (Sept. 28), Amer. Mus. Novitates, no. 187, p. 8—Huarandosa, Chinchipe Valley, Perú; ♂; Amer. Mus. Nat. Hist.

The characteristics of this subspecies have been given in an earlier paragraph. It is known only from the three original specimens from the type locality.

Tachyphonus cristatus cristatellus Sclater

Tachyphonus cristatellus Sclater, 1862, Cat. Coll. Amer. Birds, p. 86—New Granada [=Bogotá, Colombia]; ♂; British Mus.

The strongly reddish crest of this form, with the buff frontal band strongly developed and carried posteriad along the sides of the crown, distinguishes this subspecies from the other Peruvian members of the species. One example is at hand from Apayacu, east of the mouth of the Napo, in Perú, and one other from Loretoyacu, formerly in Perú but now in Colombia. Records from Pebas, which lies between Apayacu and Loretoyacu on the north bank of the Amazon, presumably belong to this form.

Tachyphonus cristatus fallax, new subspecies

Type: From Puerto Indiana, mouth of the Río Napo, Perú. No. 232913, American Museum of Natural History. Adult male collected August 3, 1926, by Carlos Olalla and sons.

Diagnosis: Similar to *T. c. cristatus* of French Guiana but with slightly shorter tail; coronal patch of males averaging more orange, less scarlet, in hue; buff frontal band less well developed and less extended along the sides of the crown. Even more noticeably different from the intervening *T. c. cristatellus* by the lighter crown and less-developed buffy frontal band. Differs from *huarandosae* by the shorter crest of the males (10-13.5 mm. instead of 14.3–17).

Range: Eastern Ecuador and northeastern Perú, crossing the upper Amazon to the lower Ucayali.

Description of Type: General color dull black; crest slightly redder than Orange Chrome, separated from the black frontal band by an indistinct and narrow area of dull Pinkish Buff; long occipital crest-feathers 10 mm. in length; lower back rich Cinnamon-Buff; upper tail-coverts black like the mantle. An oval, restricted throat patch deep Cinnamon, not reaching the base of the bill; inner margins of secondaries basally whitish; most of under wing-coverts white, but a broad stripe along carpal margin blackish. Bill (in dried skin) blackish; feet blackish. Wing, 77 mm.; tail, 64; exposed culmen, 13; culmen from base, 15; tarsus, 19.

Remarks: Females not certainly distinguishable from those of *T. c. cristatus*, although some examples at hand have the throat a little paler than available specimens of *cristatus*.

The short crest of the males of this form furnishes the only certain character to distinguish it from *huarandosae* of the Chinchipe Valley. In ascertaining this measurement, the length of the occipital feathers should be taken rather than the distance from the exposed base of the culmen to the tip of the crest, since stretching or contraction of the skin of the head in preparation of the specimen will give a totally false conclusion.

Records from Iquitos and the Río Tigre in Perú should belong to *fallax*.

Tachyphonus cristatus pallidigula, new subspecies

Type: From Mocajuba, Rio Tocantins, Brazil. No. 431554, American Museum of Natural History. Adult male collected November 24, 1931, by Alfonso M. Olalla.

Diagnosis: Similar to *T. c. brunneus* of Rio de Janeiro and other parts of easternmost Brazil, but crest shorter and deeper red; throat and uropygium lighter ochraceous. Similar to *T. c. madeirae* of the Rio Madeira region but throat and uropygium paler. Measurements inconclusive, being intermediate between the two forms mentioned.

Range: Eastern Pará district, including the lower Tocantins.

Description of Type: General color between Fuscous and Fuscous Black; top of the head largely occupied by an elongated crest of Scarlet-Red (slightly inclined toward Scarlet), with the long occipital feathers 13 mm. in length; the blackish area across the front at the base of the bill separated from the red of the crest by a narrow bar of Cream Buff continued very finely along the sides of the coronal patch for a short distance; lower back Cream Buff × Chamois, but upper tail-coverts like the mantle. Throat with a central oval area of Cream Buff × Cartridge Buff, not reaching the base of the bill. Wings externally uniform with the mantle except for a large patch of white along the radial margin; inner margins of remiges narrowly white toward the base; under wing-coverts largely white but with a blackish submarginal area near the base of the outer primaries. Bill (in dried skin) brownish black; feet dusky brown. Wing, 82 mm.; tail, 71.5; exposed culmen, 12; culmen from base, 17; tarsus, 19.

Remarks: Females near Amber Brown on the back, with the upper tail-coverts somewhat brighter; top of the head darker and warmer, with the forehead and lores noticeably paler and duller. Under parts warm Ochraceous-Buff, slightly paler on the throat and darker and browner on the flanks. Wings near Saccardo's Umber, with brighter margins on the remiges and upper wing-coverts; under wing-coverts near Pinkish Buff, approaching the color of the breast near the carpal margin; inner margins of remiges largely whitish or pale pinkish buff. Tail near Saccardo's Umber with brighter outer margins on the rectrices. Bill (in dried skin) brown; mandible more whitish on lower portion; feet brown.

Worn and faded females may lose much of the color in the plumage and appear much duller than fresher individuals.

Specimens Examined

T. c. cristatus.—
French Guiana:
Tamanoir, 1 ♂;
Pied Saut, 1 ♂, 1 ♀;
"Cayenne," 3 ♂;
Ipousin, 1 ♀.
Brazil:
Faro, 7 ♂, 6 ♀;
Obidos, 3 ♂.
T. c. intercedens.—
Dutch Guiana:
Lelydorp, Paramaribo, 1 ♂;
"interior," 2 ♂, 1 ♀.
British Guiana:
(Bartica Grove, Tumatumari, Potaro Landing, Rockstone, Demerara, and "British Guiana"), 10 ♂, 4 ♀.
Venezuela:
Mt. Auyan-tepui, 2 ♂, 2 ♀.
T. c. orinocensis.—
Venezuela:
Río Caura (Nichare River, Suapure, La Prisión, La Union, La Vuelta), 15 ♂, 3 ♀;
Sabana Canaracuni, 1 ♂[1].
Río Orinoco, Maipures, 1 ♂;
Caño Cataniapo, 3 ♂[1], 2 ♀[1];
Sanariapo, 2♂[1], 1 ♀ (type)[1];
Isla Ratón, 1 ♀[1];
Caño Cuão, 1 ♂[1], 1 ♀[1];
San Fernando de Atabapo, 4 ♂[1], 3 ♀[1];
Río Paragua, Río Tonoro, 2 ♂[1].
T. c. cristatellus.—
Colombia:
"Bogotá," 2 [♂], 3 [♀];
opposite Tahuapunto, Rio Uaupés, Brazil, 1 ♀;
Loretoyacu, 1 ♂.
Venezuela:
Mt. Duida (Caño Seco, Caño León, Foothills Camp, "Pie del Cerro," Campamento del Medio, Playa del Río Base, Valle de los Monos, Río Pescada, Esmeralda, and western foot of Duida); 27 ♂, 12 ♀;
Río Orinoco, La Laja, 2 ♂, 1 ♀;
Río Cassiquiare (Solano, Buena Vista, El Merey, opposite El Merey, mouth of Río Ocamo, opposite mouth of Ocamo), 11 ♂, 7 ♀;
Río Huaynia, junction of the Cassiquiare, 8 ♂, 4 ♀;
terrain between the Huaynia and the Cassiquiare, 1 ♂.
Brazil:
Rio Uaupés, Tahuapunto, 1 ♂, 1 ♀;
Iauarete, 2 ♂, 2 ♀;
Rio Negro (Tatú, Yucabí, San Gabriel, Tabocal, Santa Maria, Camanaos, Mt. Curycuriari, Muirapinima, Igarapé Cacao Pereira, and Manaos), 24 ♂, 17 ♀, 1 (?).
Perú:
Apayacu, 1 ♂.
T. c. fallax.—
Ecuador:
Río Suno, above Avila, 3 ♂, 2 ♀;
lower Río Suno, 1 ♀;
mouth of Lagarto Cocha, 1 ♂, 1 ♀;
below San José, 1 ♂, 1 ♀;
El Loreto, 1 ♂;
Sarayacu, 2 ♂.
Perú:
Mouth of Río Curaray, 4 ♂, 1 ♀;
Puerto Indiana, 1 ♂ (type);
Río Mazán, 1 ♀;
Sarayacu, 1 ♂.
T. c. huarandosae.—
Perú:
Huarandosa, 3 ♂ (incl. type).
T. c. madeirae.—
Brazil:
Teffé, 2 ♂, 3 ♀;
Rio Madeira, Rosarinho, 1 ♂, 1 ♀;
Borba, 1 ♂;
Igarapé Auará, 3 ♂, 1 ♀;
Humaythá, 1 ♂;
Calamá, 4 ♂ (incl. type);
Matto Grosso, Barão Melgaço, 1 ♂, 1 ♀;
Rio Roosevelt, Camp 8, 1 ♂;
Villa Bella Imperatríz, 6 ♂, 2 ♀;
Rio Tapajoz, Igarapé Brabo, 7 ♂, 3 ♀;
Limoãl, 3 ♂, 1 ♀;
Caxiricatuba, 2 ♂, 2 ♀, 1 (?);
Boim, 1 ♀;
Rio Xingú, Villarinho do Monte, 1 ♀;
Taparä, 5 ♂, 5 ♀.
T. c. pallidigula.—

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[1] Specimens in collection of William H. Phelps, Caracas, Venezuela.

BRAZIL:
Rio Tocantins, Mocajuba, 5 ♂ (incl. type), 3 ♀;
Baião, 3 ♀;
Pará, 1 ♂;
Peixe-Boi, 1 ♂;
Igarapé Assú, 2 ♂;
Benevides, 1 ♂, 1 ♀;
Patagonia, 1 ♀.

T. c. brunneus.—
BRAZIL:
Pernambuco, São Lourenço, 1 ♂;
Bahia, Taguaquará, 2 ♂;
Cajazeiras, 3 ♂, 3 ♀, 1 (?);
"Bahia," 3 ♂, 2 ♀;
Minas Geraës, Resplendor, 1 ♂, 1 (?);
São Benedicto, 1 ♀;
Espirito Santo, Baixo Guandú, 4 ♂, 1 ♀;
Lagôa Juparaná, 3 ♂, 2 ♀;
"Rio de Janeiro," 4 ♂, 2 ♀;
São Paulo, São Sebastião, 4 ♂;
"Prov. S. Paulo," 1 ♂.

Tachyphonus surinamus napensis Lawrence

Tachyphonus Napensis LAWRENCE, 1864, Ann. Lyceum Nat. Hist. New York, vol. 8, p. 42—"Napo River" (part *errore*); ♂♂; cotypes in Amer. Mus. Nat. Hist.

Tachyphonus surinamus saturatus PINTO, 1941 (May 9), Papeis Avulsos Dept. Zool., Secr. Agr. São Paulo, vol. 1 (22), p. 209—Santa Cruz, right bank of Rio Eirú, Brazil, above Juruá near São Felipe or João Pessôa; ♂; Museu Paulista.

Tachyphonus surinamus uropygialis GYLDENSTOLPE, 1941 (June 26), Arkiv. Zool., vol. 33 B (no. 12), p. 2—João Pessôa, upper Rio Juruá, Brazil; ♂; Stockholm Mus.

There is some uncertainty with respect to the name that must be applied to this excellent subspecies. Hellmayr (1907, Novit, Zool., vol. 14, p. 45) commented on the deeply colored rump of a male from Teffé, Brazil, and somewhat later (1930, Field Mus. Nat. Hist., zool. ser., vol. 17, p. 451), I noted the same characteristic in a male from Puerto Bermúdez, Perú, but there was not sufficient material available in either case to determine the constancy or geographic significance of the variation.

Still more recently, Pinto and Gyldenstolpe independently described a new form based on the character mentioned, and a series of birds from northeastern Perú south of the upper Amazon amply substantiates the validity of the distinction. The males are separable from those of *brevipes* and *surinamus* by the much deeper rufescence of the rump and crest, with the patches on the sides of the breast pure white and well developed. Females are not certainly recognizable from those of *brevipes*, although they are more strongly colored on the anterior under parts than those of *surinamus* and *insignis*.

Unfortunately, one of the two cotypes of *napensis*—the better of the two skins and the one from which Lawrence must have taken most of his characters—belongs to this dark-rumped form; the other is a specimen of *brevipes*. It would be possible to restrict the name "*napensis*" to the form that actually occurs on the Río Napo, which is *brevipes*, and credit to misidentification the assignment of the other cotype to the same form, except for a number of considerations. In the first place, as noted above, Lawrence must have taken most of his descriptive details from the dark-rumped bird. He describes the rump of *napensis* as "chestnut" or "reddish chestnut" and, although the area in the specimen in question is lighter than would be called "Chestnut" according to the relatively recent charts of Ridgway's "Color standards and color nomenclature" (being Xanthine Orange × Sanford's Brown), in the other specimen it is decidedly lighter (near Mars Yellow × Ochraceous-Tawny) and hardly likely to be called "chestnut" even in comparison with the Ochraceous-Buff or Light Ochraceous-Buff (Lawrence called it "pale fulvous") of *T. surinamus surinamus* with which Lawrence compared his new form. Furthermore, comment is made in the original description about the "reddish fulvous orange" of the crest which is said to be "less in extent" than in *surinamus*, but so little of this crest remains in the lighter of the two cotypes that its extent is indeterminable, while the existing feathering is deep Cinnamon-Buff. In the other skin it is as described. The only character that could have been taken exclusively from the light-rumped bird is the measurement of the tail—$2^{12}/_{16}$ inches. Lawrence gives $2^{11}/_{16}$ and the dark-rumped bird measures just over $2^{8}/_{16}$. Possibly Lawrence considered the larger measurement to be more satisfactory for some reason, although the tails of both specimens are equally well developed.

With this confusion and the composite nature of Lawrence's material, it would still be possible to continue the acceptance of "Napo River" as the type locality of *napensis* and arbitrarily restrict the concept of that form to the Napo population together with such other populations as agree with it. However, Chapman (1917, Bull. Amer. Mus. Nat. Hist., vol. 36, p. 616) "selected" the dark-rumped example as the [lecto] type of *napensis*, and a certain school of zoologists who accept the principle of the lectotype will be able to argue that this has automatically closed the door to any subsequent rearrangement. Although I much prefer the principle of restriction of type locality to that of lectotype specimen, I dislike to suggest a procedure that could result in continual conflict between the two schools of thought.

The best solution seems to be one that will reconcile them. There is no doubt as to the identity of the specimen that Chapman selected as type of *napensis*, but there is grave doubt that it was collected on the Napo River. I have examples from various localities along the course of that stream down to its mouth, and all of them are of the lighter-rumped coloration recognizable in *brevipes*. The darker-rumped example, therefore, probably came from the south bank of the upper Amazon, perhaps directly across from the mouth of the Napo. The collector, William E. Moore, is credited by Lawrence (1858, Ann. Lyceum Nat. Hist. New York, vol. 6, p. 259) with having crossed South America near the equator, and although all of his birds in the Lawrence collection that I have seen are labeled "Napo," I have found an occasional specimen that disagrees with the assigned locality (see account of *Lanio v. versicolor*).

In view of the present considerations, then, it is necessary to assign a new type locality to Lawrence's "*napensis*," and for this purpose I suggest Orosa, Perú, somewhat east of a point directly across the Amazon from the mouth of the Napo and a region where birds matching the darker of Lawrence's two skins are found. This necessity for reassignment is regrettable since it gives the name *napensis* to a form not found on the Napo. The same difficulty would, of course, have arisen had Lawrence had but the single dark-rumped specimen before him.

The Puerto Bermúdez specimen furnishes the only earlier record from Perú.

Tachyphonus surinamus brevipes Lafresnaye

Tachyphonus brevipes Lafresnaye, 1846, Rev. Zool., vol. 9, p. 206—Colombia = "Bogotá"; ♀; cotypes in Mus. Comp. Zoöl., Cambridge, Mass.

This Andean form has a rather broad range, occurring on the eastern side of the Andes from eastern Colombia to the north bank of the Amazon in Perú, from Pomará to the mouth of the Napo, crossing the Marañón to the lowlands between the middle Marañón and the Huallaga. Eastward it is found on the upper Rio Negro and on the Cassiquiare, but at the mouth of the Negro (both banks) and about Mt. Duida and the Orinoco, it is replaced by *T. s. surinamus*. The Cassiquiare birds show a trend toward *surinamus* in a little lighter coloring of the rump and an occasional suggestion of buff on the white latero-pectoral patches, but they are closer, on average, to the Rio Negro and Andean series.

It is possible, also, that the Rio Negro birds have the latero-pectoral patches slightly less extensive, on average, than the Andean birds, but the distinction is not clear and, in any case, not constant. Authors have reported these patches to be smaller in *brevipes* than in *surinamus*, but this distinction is not consistent, and much the same degree of variation exists in both forms throughout their ranges. The pale buffy rump and the tinge of buff on the sides of the breast in the males furnish the best characters for the recognition of *surinamus*. The females are much like those of *insignis* of the south bank of the lower Amazon and Pará, being paler below than those of *brevipes*, at least on average.

Additional records of *brevipes* are from Iquitos and Moyobamba.

SPECIMENS EXAMINED

T. s. surinamus.—
DUTCH GUIANA:
("Surinam," "interior," and Paramaribo), 9 ♂, 6 ♀.

- French Guiana:
  - (Ipousin and "Cayenne"), 3 ♂.
- British Guiana:
  - (Bartica Grove, Tumatumari, Wismar, Potaro Landing, Rockstone, Minnehaha Creek, and "Demerara"), 8 ♂, 7 ♀, 1 (?).
- Venezuela:
  - (Mt. Auyan-tepui, Guanoco, Suapure, Nichare western foot of Duida, Valle de los Monos, Caño Seco, Playa del Río Base, Pie del Cerro, and Boca de Sina), 35 ♂, 20 ♀.
- Brazil:
  - (Manaos and Igarapé Cacao Pereira), 2 ♂.

T. s. brevipes.—

- Venezuela:
  - (Río Cassiquiare—El Merey, Buena Vista, and Solano), 4 ♂, 1 ♀.;
  - junction of Huaynia and Cassiquiare, 5 ♂, 3 ♀;
  - terrain between Huaynia and Cassiquiare, 1 ♂, 1 ♀.
- Brazil:
  - (Tatú, Yucabí, Tahuapunto, and Iauarete), 12 ♂, 14 ♀.
- Colombia:
  - Opposite Tahuapunto, Brazil, 1 ♂, 1 ♀;
  - La Morelia, 3 ♂.
  - Villavicencio, 1 ♂;
  - "Bogotá," 3 ♂, 2 ♀.
- Ecuador:
  - Río Suno, above Avila, 2 ♂;
  - lower Río Suno, 1 ♂, 1 ♀;
  - below San José, 1 ♀;
  - Coca, 1 ♂;
  - "Napo," 1 ♂ (a cotype of *napensis*).
- Perú:
  - Mouth of Río Curaray, 3 ♂, 1 ♀;
  - Puerto Indiana, 1 ♂;
  - mouth of Río Santiago, 1 ♂;
  - Pomará, 6 ♂, 3 ♀;
  - Chayavitas, 2 ♂;
  - Jeberos, 4 ♀.

T. s. napensis.—

- Perú:
  - Orosa, 11 ♂, 5 ♀;
  - Río Ucayali, Lagarto, 2 ♂, 1 ♀;
  - Santa Rosa, 4 ♂;
  - Puerto Bermúdez, 1 ♂[1].
- Brazil:
  - Teffé, 1 ♂, 1 ♀.
- Perú or Brazil:
  - "Napo" (*errore*), 1 ♂ (cotype and "lectotype").

T. s. insignis.—

- Brazil:
  - Rio Madeira, Borba, 1 ♂;
  - Villa Bella Imperatríz, 8 ♂;
  - Rio Tapajoz (Santarem, Limoãl, Tauarý, and Caxiricatuba), 7 ♂, 6 ♀, 1 (?);
  - Rio Xingú (Porto de Moz and Villarinho do Monte), 4 ♂, 2 ♀; Rio Tocantins (Mocajuba and Baião), 3 ♂, 3 ♀;
  - Pará (Utinga, Patagonia, Peixe-Boi, Igarapé Assú, Prata, Ananindeua, and "Pará"), 10 ♂, 7 ♀;
  - Pará, Bemfica, 2 ♂ (incl. type).

Tachyphonus phoenicius Swainson

Tachyphonus phoenicius Swainson, 1837 (Dec. 11), Anim. in Menag., p. 311—"Inhabits —? In the collection of Mr. Horsfield of Everton, near Liverpool, who believes it came from Fernando Po, on the African coast" (*errore*); subst. eastern Perú, Berlepsch, 1908; subst. Cayenne, Berlepsch, 1912.

Tachyphonus saucius Strickland, 1844, Ann. Mag. Nat. Hist., vol. 13, p. 419—"Colombia or Central America" (*errore*); University Mus., Cambridge, England.

Berlepsch (1912) gives no reasons for altering his earlier restriction of type locality from eastern Perú to Cayenne, and until the type is found, if ever, the original restriction should stand. There is, furthermore, no positive record from French Guiana except for the purchased skin (? trade skin) without definite locality, in the British Museum. Two certain localities are available in eastern Perú. The matter of type locality may prove to be of importance since there is a possibility of distinguishing two forms of the species, one north and one south of the Amazon.

Two adult males from near Moyobamba, Perú, an adult male from Borba, and one from Vilhena, Matto Grosso, Brazil, are doubtfully distinct from examples collected North of the Amazon in Brazil, Venezuela, and British Guiana. They have the bill somewhat stubbier than the northern birds—wider at the base in proportion to the length and shorter than most of the others—and the red area on the shoulder appears to be slightly less extensive. A female from Río Negro, Perú, and another Borba bird, sexed as a male but probably a nearly adult female, has the bill no different from comparable specimens from the north, but a female from Humaythá agrees with the adult males in this respect. More material from south of the Amazon will be needed to determine the validity of the characters noted.

In any case, before any name can be applied to any separable form, it will be necessary to determine the application of the name *saucius* as well as of *phoenicius*. In the meantime, the species may be left intact under the name *phoenicius* with type locality eastern Perú.

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[1] Specimen in Chicago Natural History Museum.

The apparently interrupted distribution of this species is unexplainable in view of our paucity of information concerning its habits. The young Borba bird is inscribed (transl.) "Noted in the savanna. Does not fly in the forest."

Peruvian records are from Jeberos and "E. Perú." The citation of "Cuzco (coll. Raimondi)" by Taczanowski (1884, Orn. Pérou, vol. 2, p. 506), is without confirmation and probably erroneous.

SPECIMENS EXAMINED

T. phoenicius.—
  PERÚ:
    Río Negro, west of Moyobamba, 2 ♂, 1 ♀.
  BRAZIL:
    Borba, 1 ♂, 1 "♂" [? = ♀];
    Humaythá, 1 ♀;
    Faro, 2 ♂.
  VENEZUELA:
    Mt. Duida (Campamento del Medio, Primer Pico, Primer Campamento, Valle de los Monos, Cerros de Sabana, and Savana Grande), 12 ♂, 6 ♀, 1 (?);
    Mt. Roraima, 2 ♂;
    Mt. Auyan-tepui, 9 ♂, 6 ♀.
  BRITISH GUIANA:
    River Carimang, 1 ♀.
  DUTCH GUIANA:
    "Interior," 1 ♂.

Tachyphonus rufiventer (Spix)

Tanagra rufiventer SPIX, 1825, Av. Bras. Spec. Nov., vol. 2, p. 37, pl. 50, fig. 1—"in sylvis Parae," *errore*, subst. São Paulo de Olivença, Brazil, by Hellmayr, 1920.

"*Tachyphonus serrirostris* Strickl." STONE, 1899, Proc. Acad. Nat. Sci. Philadelphia, p. 47—cited in synonymy of "*Tachyphonus rufiventer* Spix."

Tachyphonus metallactus OBERHOLSER, 1919 (Dec.), Proc. Biol. Soc. Washington, vol. 32, p. 240—new name for *Tanagra rufiventer* Spix (*nec Tanagra rufiventris* Vieillot, 1819).

There appears to be no significant differentiation in birds from different parts of the range in Perú, and authors have found none in northwest-Brazilian and Bolivian examples. There is individual variation in the development of the black pectoral band in the males as well as in the depth of yellow on the crest and the tone of rufescence on the under parts or even on the rump. Females vary likewise in the clarity of the gray on the head and the amount of buffy tinge on the throat or of brown on the uropygium. Young birds have the throat as yellow as the breast and the top of the head as green as the back. These differences appear without regard to locality.

The International Rules of Zoological Nomenclature do not require that the name *rufiventer* be discarded because of an earlier *rufiventris*. Fortunately, *rufiventris* is still in the original genus *Tanagra*, far removed from possible confusion with *Tachyphonus*.

There is a further complication in the nomenclature of this species that is avoided by continuing the use of *rufiventer*, aside from the fact that *rufiventer* is the valid name. Stone (1899, Proc. Acad. Nat. Sci. Philadelphia, p. 47) recorded specimen no. 7659 of the Academy's collection as the type of "*Tachyphonus serrirostris* Strickl.," giving the reference of "Contr. Orn., 1850, p. 49," but identifying the bird as "*Tachyphonus rufiventer* Spix." Strickland never published the name "*serrirostris*," although he may have written this name on the label of his specimen prior to his belated discovery that Spix had already described and figured the species, as he discusses in the reference given by Stone. In any case, Stone's publication of the name "*serrirostris*" identified as *Tachyphonus rufiventer* Spix (although Spix's name should have been put in parentheses) would seem to validate it as of 1899 as an available name for *rufiventer* in case this latter name were not usable. Its author is, therefore, Stone, but its type would be identical with that of the original *rufiventer*. Such procedure was invalidated by the International Commission of Zoological Nomenclature as of January 1, 1931, but Stone's action antedates this amendment to Article 25 of the International Code.

Peruvian records of *rufiventer* are from the Río Javari, Moyobamba, Chamicuros, Huambo, Nuevo Loreto, La Merced, Borgoña, Monterico, Cosñipata, Yahuarmayo, San Gaban, Chaquimayo, Huaynapata, and Marcapata.

SPECIMENS EXAMINED

T. rufiventer.—
  PERÚ:
    Río Seco, 1 ♀;

Rioja, 1 ♂[1].
Yurimaguas, 1 ♂;
Chayavitas, 1 ♂;
Sarayacu, 4 ♂, 1 ♀;
Lagarto, 2 ♂, 2 ♀;
mouth of Río Urubamba, 1 ♀;
Vista Alegre, 2 ♂[1], 2 ♀[1];
Chuchurras, 1 ♂, 1 ♀;
Perené, 1 ♂, 1 ♀, 1 (?);
Río Cosireni, 1 ♀;
La Pampa, 2 ♂, 2 ♀;
Río Tavara, 2 ♂, 2 ♀;
Santo Domingo, 2 ♂.

Tachyphonus luctuosus luctuosus D'Orbigny and Lafresnaye

T[achyphonus] luctuosus D'ORBIGNY AND LAFRESNAYE, 1837, Mag. Zool., vol. 7, cl. 2, "Syn. Av.," p. 29—Guarayos, Bolivia; ♂, ♀; cotypes in Paris Mus.

I am unable to separate Peruvian examples from Bolivian specimens.

This form has a wide range over much of South America from Bolivia and the Matto Grosso plateau of Brazil northward to the northern part of Venezuela. It reaches the eastern side of the Andes in Perú, Ecuador, and Colombia but does not cross to the western side, although various examples of *T. l. panamensis* from western Ecuador are hardly distinguishable, as will be discussed below. Peruvian records are from Sarayacu, Rió Ucayali.

I am inclined, however, to recognize a Trinidad subspecies that also occurs on the mainland of northeastern Venezuela at Cristóbal Colón and, apparently, Cumanacoa, although available Quebrada Seca and Guanoco skins are inseparable from *luctuosus*. The exact distribution here remains to be accurately determined. In any case, the Trinidad and Cristóbal Colón birds have noticeably large bills like *panamensis* but without the relatively long white wing-patch of that form in the male plumage.

The question arises as to the best name to use for the Trinidad form, since five names have been applied to birds from that region. The first of these, *Chlorospingus flaviventris* Sclater (July, 1856, Proc. Zool. Soc. London, vol. 24, p. 91), was based on two females—one from Trinidad in the collection of William Jardine, now lost, and one from "? Bolivia" in the collection of H. E. Strickland, now in the University Museum of Cambridge, England, where it was examined by Hellmayr and found to be rather certainly a Bolivian specimen.

The second available name is *Tachyphonus albispecularis* Léotaud (1866, Ois. Trinidad, p. 300), was based on specimens of both sexes from Trinidad in the author's collection, known to have been destroyed by fire. There is thus little advantage in either name so far as the availability of the cotypes from Trinidad are concerned, although there is a very slight possibility that Strickland's specimen may some day be found. Since the name based on this bird and its Bolivian conspecies is ten years older than Léotaud's name, I propose, therefore, to restrict the type locality of *Chlorospingus flaviventris* Sclater (as cited above) to Trinidad and adopt that name for the large-billed form found on that island.

Other synonyms are *Lanio Lawrencii* Sclater (1885, Ibis, ser. 5, vol. 3, p. 272, pl. 6, fig. 2), a new name proposed for *Tachyphonus atricapillus* Lawrence (1868, Proc. Acad. Nat. Sci. Philadelphia, vol. 20, p. 360), which, in turn, was based on an unusual specimen discussed below; and *Chlorospingus leotaudi* Chapman (1893, Auk, vol. 10, p. 342), based on a female from Trinidad.

Both Chapman's and Lawrence's types are before me. Chapman's bird is a perfectly normal female of *flaviventris*, but Lawrence's specimen requires some discussion. The figure given by Sclater (1885) is helpful, as are both Sclater's and Lawrence's descriptions, but the specimen indicates something more than a simple immature plumage. Sclater's intimation that indications of black were coming out on the interscapulium is misleading, since there is no molt in progress and the black mentioned consists of dull blackish marks on otherwise dark olive green feathers. In fact, the feathering appears to be adult except for its abnormal pigmentation, and this is not a sign of immaturity since it is not that of the immature birds of either sex. The specimen is rather certainly an abnormal adult, either an "advanced" female or a "retarded" male. Although the rufescent coloration of part of the under side suggests the possibility of admixture of another species in which some of this rufescence normally occurs, I can find no other suggestions of hybridism and believe that the individual in question is of a pure strain, however abnormal in other respects.

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[1] Specimens in Chicago Natural History Museum.

With regard to *T. l. nitidissimus*, I am unable to find any mention of one of the outstanding characters by which this form may be known in the female plumage as well as in that of the males. This character consists of the strong demarcation of color on the basal half of the mandible. In all forms of *luctuosus* there is a certain amount of differentiation in that region, usually no more than a more slaty, less deeply black basal area, although it sometimes shows a definite pallid tone. In *nitidissimus*, however, there is a quite sharply defined flesh-colored patch that is quite conspicuous. The nearest approach to this condition occurs, as might be expected, in the adjacent *axillaris*.

The taxonomic and geographic limits of *T. l. panamensis* are not entirely satisfactory. From the Canal Zone through eastern Panamá, across Colombia to the western side of the Eastern Andes, and south along the western side of the Western Andes into western Ecuador, there is a certain amount of agreement in respect to a relatively large bill and long white shoulder patch, reaching, in many examples, posteriad to the upper primary-coverts. The latter character is not always easily discernible since abrasion of the plumage and the preparation of the skin sometimes conceal the true condition. As a matter of fact, certain examples show the apparent length of the white area different on the two wings! In order to obtain a better standard of comparison, the posterior inner white feathers were measured individually. This showed that in eastern Panamá the feathers in question were 13.5–15 mm. long; in central Colombia, 14.5–16; in western Colombia, 14–15; in western Ecuador, 12–14.

In lengths of wing and tail, there is similar variation. The birds of eastern Panamá have the wing, 62.1–67 mm. (average, 64.1); tail, 48–56.5 (average, 52.5). Central Colombia: wing, 66–71 (average, 68.2); tail, 54–60.5 (average, 58.1). Western Colombia (2 skins): wing, 65–67; tail, 54–54.5. Western Ecuador: wing, 58–63.9 (average, 61); tail, 47–53 (average, 50).

In these measurements, as in the extent of the white shoulder patch, the birds from Panamá overlap both the west-Ecuadorian and the central-Colombian specimens, but the Colombian and Ecuadorian series do not quite meet. Even the west-Colombian birds do not form a good transition between the Panamanian and Ecuadorian populations since they are on the borderline between the Panamanian and central-Colombian series. Nevertheless, there is too great an overlap between the Panamanian and Ecuadorian birds to justify their distinction, as there is between the Panamanian and Colombian populations.

Three of 10 central-Colombian males and six of 30 Panamanian and west-Colombian specimens fall in the zone of intermediacy in respect to length of wing, while three central-Colombian and nine Panamanian and west-Colombian examples similarly overlap in respect to the length of tail. Between Panamá and Ecuador, 17 of a total of 50 birds overlap in length of wing and 39 in length of tail. As stated above, there is no overlap between Colombia and Ecuador. I have included in the central-Colombian series three Bogotá trade-skins that have large bills and long white inner wing-coverts. One other "Bogotá" bird is uncertain, having the wing and tail within the measurements of the central-Colombian specimens but the white wing-coverts relatively short and the bill not decisively large. It agrees better with typical *luctuosus* from the eastern side of the Eastern Andes where three more Bogotá skins certainly belong. The inclusion of the three Bogotá birds with the central-Colombian series does not alter the extremes of measurement or the averages for that series.

In view of the above figures, therefore, it seems inadvisable to attempt to subdivide *panamensis*, although it leaves that form as a variable one, with the largest examples in Colombia and the smallest in western Ecuador. The small size of the last-named may be explained as a possible trend toward *luctuosus luctuosus* of eastern Ecuador from which the smallest and smallest-billed examples from the west are not always distinguishable.

Females were not measured in detail, but inspection shows the same tendencies noted in the males. The largest and especially largest-billed birds are from central Colombia and the smallest from western Ecuador where there is not always obvious distinction from *luctuosus luctuosus*.

Specimens Examined

T. l. axillaris.—
  Costa Rica:
    (Carrillo, Limón, Bonilla, and Aquinares), 8 ♂.
  Nicaragua:
    (Río Grande and Peña Blanca), 5 ♂.
  Panamá:
    Almirante, 1 ♂, 5 ♀.
T. l. nitidissimus.—
  Costa Rica:
    (Orotina, Volcán de Oso, Puerto Jimenez, Boruca, Buenos Aires, Pozo Azul de Pirrís, and Térraba), 9 ♂, 5 ♀.
  Panamá:
    (Bogava, Chiriquí, Boquete, Boqueron, Veragua, Iguaros Is., Medidor Is., and Cebaco Is.), 10 ♂, 2 ♀.
T. l. panamensis.—
  Panamá:
    (Río Sambú, Tocumé, Tacarcuna, Cape Garachiné, Tapalisa, Barro Colorado, Chepigana, El Real, Capeti, Darien, Gatún, and Lion Hill), 29 ♂, 6 ♀, 1 (?).
  Colombia:
    (Opon, Río Frío, Dabeiba, La Florida, Juntas de Tamaná, Remedios, Chicoral, and "Bogotá"), 12 ♂, 5 ♀.
  Ecuador:
    (Esmeraldas, coast of Manaví, Chone, Río de Oro, Chimbo, Coco, Río Jubones, Gualea, Naranjo, San Nicolas, La Chonta, and Chongon Hills), 23 ♂, 3 ♀.
T. l. luctuosus.—
  Colombia:
    La Morelia, 1 ♂;
    "Bogotá," 3 ♂.
  Ecuador:
    (Río Suno above Avila, lower Río Suno, below San José, Río Coca, Coca and "Napo") 10 ♂, 5 ♀.
  Perú:
    Mouth of Río Curaray, 3 ♂, 1 ♀;
    mouth of Río Santiago, 1 ♂, 2 ♀;
    Pachiza, 1 ♂;
    mouth of Río Urubamba, 1 ♂, 1 ♀;
    Santa Rosa (Ucayali), 2 ♀;
    Astillero, 2 ♂, 1 ♀.
  Bolivia:
    (Todos Santos, Mission San Antonio, mouth of Río San Antonio, San Mateo, and Province of Sara), 25 ♂, 9 ♀, 1 (?).
  Brazil:
    Matto Grosso, Broken Canoe Rapids, 1 ♂;
    6th of March Rapids, 1 ♂;
    Rio Maecurú, 1 ♀;
    Rio Madeira (Rosarinho, Santo Antonio de Guajará, Borba, Humaythá, Alliança, Calamá, and Igarapé Auará), 19 ♂, 10 ♀, 1 (?).
    Teffé, 1 ♀;
    Villa Bella Imperatríz, 8 ♂, 4 ♀;
    Rio Tapajoz (Aramanay, Piquiatuba, and Itaituba), 4 ♂, 1 ♀;
    Rio Tocantins (Mocajuba and Pirunhum), 3 ♂, 1 ♀;
    Rio Negro, Igarapé Cacao Pereira, 1 ♂;
    Obidos, 1 ♂, 1 ♀.
  British Guiana:
    Upper Mazaruni River, 1 ♂.
  Venezuela:
    Mt. Duida (Caño León and Playa del Río Base), 4 ♂, 1 ♀;
    Río Orinoco (mouth of Río Ocamo, and 1 kilometer above Ihuapo), 2 ♂, 2 ♀;
    Río Caura (La Unión, Suapure, La Prisión, and Nichare), 12 ♂, 3 ♀;
    Río San Feliz, La Cascabel, 1 ♂;
    Guanoco, 2 ♂;
    El Llagual, 1 ♂.
T. l. flaviventris.—
  Trinidad:
    "Trinidad," 2 ♂ (incl. type of *atricapillus*);
    Princestown, 1 ♀ (type of *leotaudi*).
  Venezuela:
    Cristóbal Colón, 2 ♂;
    Cumanacoa, 2 ♂.

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RESULTS OF THE ARCHBOLD EXPEDITIONS. NO. 55

NOTES ON THE SQUIRREL-LIKE AND MOUSE-LIKE POSSUMS (MARSUPIALIA)

BY G. H. H. TATE

Due to the indefatigable work of the Archbold New Guinea Expeditions, good series of many rare species hitherto lacking from, or scarcely represented in, the collections of the American Museum have been obtained. Notable among them is the fine representation of the New Guinea dormouse possum, *Eudromicia caudata.* Other material reported on includes the Australian collections made by the late Henry C. Raven and by Gabriele Neuhäuser.

One new form of *Dactylopsila trivirgata* is described.

All but one of the members of the two phalangerid subfamilies included in this paper are referable to the Phalangerinae; *Schoinobates,* the greater possum glider, belongs to the Phascolarctinae.

Subfamily **Phalangerinae**

Eight genera, excluding *Phalanger,* recently reviewed (Tate, 1945a), and *Trichosurus* (not treated here) are included in this family. Three, *Dactylopsila, Dactylonax,* and *Gymnobelideus,* are squirrel-like; *Petaurus* and *Acrobates* function like flying squirrels; *Eudromicia, Cercartetus,* and *Distoechurus* are mouse-like.

Jones (1923), perhaps as a matter of convenience, based his two primary divisions of the Phalangerinae upon the form of the tail—whether distichous or not. The presence or absence of gliding membranes was obviously held to be secondary. Yet both are interrelated functionally and are undoubtedly highly plastic characters. Other external characters dwelt upon by him included the degree of development of the toe pads and again the character of the pelage of the tail. The form of the teeth was employed only to distinguish between *Dactylopsila* and *Phalanger.* It seems better now to attempt a classification based upon apparently less readily modified characters such as those of the teeth and the skull.

The basic phalangerine pattern of dentition comprises three well-developed incisors, a canine, three premolars, the last (fourth) by far the largest (p^2_2 never developed), and four molars. The opposing lower teeth are one large central, chisel-shaped incisor, one large premolar (the fourth), between which stand a varying number of minute, nearly obsolete teeth, and four lower molars. To this pattern *Phalanger, Trichosurus, Dactylopsila, Dactylonax, Petaurus, Gymnobelideus,* and *Eudromicia* conform. *Acrobates, Distoechurus,* and *Cercartetus* are aberrant in various ways. In *Acrobates* the two upper premolars anterior to p^4 are double-rooted and quite as large as that tooth, and p_3 is as large as or larger than p_4. This condition may be secondary or it may demonstrate retention of a primitive state lost in other genera. In *Distoechurus,* as pointed out earlier (Tate and Archbold, 1937, pp. 388–390), p^3 is the dominant premolar, p^1 being only slightly smaller, but p^4 very much smaller. In the lower jaw a single premolar, probably p_3, is set off from the molars by a diastema that perhaps formerly accommodated a minute p_4. In addition, m^4_4 are absent. In *Cercartetus* the premolar system does not differ much from the supposedly typical pattern, p^4 being somewhat reduced but neither p^1 nor p^3 enlarged, but m^4_4 are obsolete. Of the three, *Cercartetus* is the least aberrant. *Distoechurus* and

Acrobates are not only markedly differentiated; they have taken quite different evolutionary courses. The distichous characters of the tails of *Distoechurus* and *Acrobates* are actually widely different, the fringe of hairs of the former being stiff, like the webs of a feather, while those of *Acrobates* are relatively soft (Jones, 1923, pp. 188–189). Moreover, though *Acrobates* has gliding membranes, *Distoechurus*, contrary to published statements, has none. I determined this point in New Guinea by examining a fresh-killed specimen (A.M. N.H. No. 105938). A final marked difference is to be noted in the mammary arrangement. Jones gives the nipple count as four in *Acrobates;* in *Distoechurus* there is a single nipple, median in position. *Cercartetus*, in which m$^4_4$ are absent, is derived directly from *Eudromicia.*

Turning next to the remaining phalangerine genera, *Eudromicia, Dactylopsila,* and *Phalanger* can be taken as relatively generalized types. Only the extreme tip of the tail is prehensile in the first two. The first is mouse-like, the second squirrel-like, the third lemur-like. *Dactylopsila,* by specialization of the fourth finger, produced *Dactylonax* but is also a close relative of *Trichosurus* (which has fewer premolars) and, probably, of the rare *Gymnobelideus.* It also gave rise to the flying phalanger, *Petaurus,* by the development of gliding membranes. The genus *Phalanger* has carried scansorial adaptations to an extreme by great development of the prehensile function of the tail, enlargement of the claws, and a general slow-down of its rate of movement. The number of young is reduced in *Phalanger* to one or two.

It may be worth while to note that taxonomic balance is still far out of adjustment in the marsupials. On the one hand the scale-tailed flying squirrels, *Anomalurus,* of Africa, and the true flying squirrels are both treated as subfamilies (or families) of the Sciuromorpha. On the other hand *Petaurus,* in which analogous specialization has occurred, is still held in a subordinate position as a genus of the Phalangerinae. The same thing holds with *Schoinobates* in the Phascolarctinae. It has still to be sufficiently recognized that the Australian marsupials include many single relicts of extremely ancient lines.

The Pygmy Possums or Possum Mice

Of the two genera of naked-tailed pygmy possums, *Cercartetus* (= *Dromicia*) and *Eudromicia,* recognized by Iredale and Troughton (1934), the first is typified by *C. nanus* of Tasmania, the second by *E. macrura* of Queensland. A few years ago I studied the type specimens of both in London as well as those of most other species and forms.

Iredale and Troughton have established the fact that *Dromicia* Gray is antedated by *Cercartetus* Gloger. The type of each is *Phalangista nana.* In January, 1916, Mjöberg proposed *Eudromicia* for his *macrura,* a Queensland species in which m$^4_4$ were present. The retention of these teeth was adduced by him as a character distinguishing *Eudromicia* from *Cercartetus* (= *Dromicia*). In April of the same year Matschie proposed *Dromiciola,* with type *lepida* of Tasmania, which Iredale and Troughton consider equal to *Eudromicia,* and *Dromiciella* with type *nana,* a pure synonym of *Cercartetus.*

Of the two genera, *Eudromicia,* in which the number of molar teeth is $\frac{4}{4}$, is the less specialized, while *Cercartetus* (= *Dromicia*) in which m$^4_4$ is not developed, is the more specialized. Apparently *Cercartetus* is derived from *Eudromicia.* The geographical range of *Cercartetus* includes the southern parts of eastern and western Australia, and Tasmania, of *Eudromicia* the whole of New Guinea, the northeastern coastal strip of Australia, and Tasmania. *Cercartetus nanus* has developed the ability to store fat during the southern winter months in the temporarily swollen basal portion of the tail, in the same way as do some species of *Sminthopsis* and the South American *Marmosa elegans* group.

Genus Eudromicia

Eudromicia Mjöberg, 1916 (January), K. Svenska Vetensk. Akad. Handl., vol. 52, no. 2, p. 13.

Dromiciola Matschie, 1916 (April), Mitt. Zool. Mus., Berlin, vol. 8, no. 2, p. 260.

Mjöberg based *Eudromicia* upon *E. macrura* of northern Queensland; Matschie founded *Dromiciola* upon *Dromicia lepida* from Tasmania. In both generic diagnoses the presence of m_4^4 is mentioned; the relatively large size of p_4 is pointed out by Matschie. I believe, with Iredale and Troughton, that *macrura* and *lepidus* are congeneric. *Dromicia caudata* of New Guinea, in which m_4^4 are present also, must be regarded as a third member of the genus.

Eudromicia caudata (Milne Edwards)

Dromicia caudata MILNE EDWARDS, 1877, Compt. Rendus Acad. Sci., Paris, vol. 85, pp. 1079–1080.

Material studied since publishing earlier (Tate and Archbold, 1937, p. 385) includes the type specimen in Paris, the skull of which was cleaned for me the same year; several other specimens in the Berlin Museum from the Huon Peninsula (Saruwaged); four from the Angabunga River in the Tring Museum; one in the British Museum brought by Shaw Mayer from Fergusson Island; also a series of 30 specimens from the Mount Wilhelmina-Lake Habbema area of Netherlands New Guinea, 5000–13,000 feet, collected by W. B. Richardson and now in the Archbold collection. These last include 19 specimens of a paler form from the Balim River, 5000 feet, and the Bele River, 7000 feet, and 11 of a very dark form from Mount Wilhelmina, 10,000–13,000 feet. The former series is colored much as typical *caudata*. The latter, though easily distinguishable by its smoky color, has the skull and dimensions of the body identical to those from lower altitudes.

Eudromicia macrura Mjöberg

Eudromicia macrura MJÖBERG, 1916, K. Svenska Vetensk. Akad. Handl., vol. 52, no. 2, p. 4.

Two specimens, Stockholm 5255 and 5256, were kindly sent me for study while I was in London. Compared with *caudata* (A.M.N.H. No. 104054), from Matsika, *macrura* is smaller, and has larger bullae and larger anterior and posterior palatal foramina. The dental characters and dimensions of the teeth are substantially the same. In other respects it is very similar, being clearly more closely related to the New Guinea specimen than to *lepida* of Tasmania.

Eudromicia lepida (Thomas)

Dromicia lepida THOMAS, 1888, Catalogue... Marsupialia and Monotremata, p. 142.

The type of this species, an adult female from Tasmania, is B.M. No. 52.1.15.11, the body in alcohol, the skull cleaned. The species is very much smaller than *E. macrura*, *E. caudata*, or *Cercartetus nanus*. The teeth are approximately equal in size to those of *C. concinnus*. There is as yet no evidence that *E. lepida* is able to store fat in the basal portion of the tail as *C. nanus* can.

GENUS CERCARTETUS

Cercartetus GLOGER, 1841 (before May), Hand- und Hilfsbuch der Naturgeschichte, vol. 1, p. 85.

Dromicia GRAY, 1841 (November), *in* Grey, Journals of two expeditions...in...Australia, vol. 2, pp. 401, 407.

Dromiciella MATSCHIE, 1916, Mitt. Zool. Mus., Berlin, vol. 8, no. 2, p. 260.

Phalangista nana Desmarest is type for both *Cercartetus* and *Dromicia; Dromicia concinna* Gould for *Dromiciella*.

Cercartetus is chiefly distinguished from *Eudromicia* by its lack of m_4^4. The sizes of p_4^4, employed by Jones (1925, p. 97) in his key, serve only to separate *concinna* from *nana, gliriformis, britta*, and *unicolor*.

Cercartetus nanus (Desmarest)

Phalangista nana DESMAREST, 1818, Nouv. Dict. d'Hist. Nat., nouv. ed., vol. 25, p. 477.

The type specimen of *C. nanus* from Maria Island, Tasmania, collected by Perron and Lesueur, Paris No. 160 (192), is a juvenal male, so young that m_2^2 are only partly erupted. The skull was extracted from the mounted skull and cleaned for me to study, in 1937.

The upper fourth premolar is a comparatively large tooth with anterior and posterior cusps; the two anterior premolars are quite small. The bullae are unusually large.

The present color of the badly faded skin is brownish gray, the underparts dirty white, with the bases of the hairs gray.

Subspecies of *C. nanus* have been named in South Australia, New South Wales, and Victoria. This obviates the need to assume that *gliriformis*, stated by Bell (1829) to have come from "Australia," was a mislabeled Tasmanian specimen. More probably *gliriformis* will supersede either *unicolor* from Sydney, New South Wales, or *britta* from South Australia.

Although the type of *nanus* has the dentition so little advanced that the status of m^4_4 cannot be determined, Iredale and Troughton have synonymized *Dromiciella* with *Cercartetus*, thus indicating their belief in the absence of m^4_4 in *nanus*. Besides this Thomas (1888, p. 146) had before him a number of other Tasmanian specimens that must have satisfactorily substantiated the molar tooth count for *nanus*. In the cases of *britta* and *unicolor* the describers specifically refer to the molar formula, m^{1-3}_{1-3}. The skull of the type of *gliriformis* has the posterior ends of the toothrows broken off, but has the large-sized teeth of *nanus* and *uniformis*. Otherwise the presence of m^4_4 in *gliriformis* is not proved. Probably the races of *nanus* should be written *nanus nanus*, Tasmania; *nanus gliriformis* = *unicolor*, New South Wales and Victoria; *nanus britta*, South Australia.

The name *nanus* is a misnomer; the teeth of *nanus* are almost as large as those of *Eudromicia caudata* and *E. macrura*. They are much larger than those of either *C. concinnus* or *E. lepida*.

Cercartetus nanus alone of the mouse opossums is recorded as storing fat in its tail during the southern winter.

Cercartetus concinnus (Gould)

Dromicia concinna Gould, 1845, Proc. Zool. Soc. London, p. 2.

Phalangista (Dromicia) neillii Waterhouse, 1846, Natural history mammals, vol. 1, p. 315.

This is the only one of the pygmy possums that has pure white underparts. The molars are three only in number, the teeth about as long as, but more compressed than, those of *E. lepidus*. Besides giving its well-known distribution in Western Australia, Jones (1925, p. 96) records it from South Australia.

I have examined the cotypes from the Swan River in the British Museum and one at the Tring Museum from Preston, southwest Western Australia; also the type of *neillii*.

The Squirrel-like Possums

Dactylopsila trivirgata

The following specimens have been either studied in European museums or added to the Archbold collections since 1937. The types of *trivirgata*, *albertisii* (= *angustivittis*), *occidentalis*, *arfakensis*, *kataui*, *picata*, *biedermanni*, *melampus*, *hindenburgi*, and *megalura* have been examined. New material representing known races in the Archbold collection comprises one *kataui* from upper Fly River, four *kataui* from south New Guinea, two *melampus* from the Kokoda Road, north of Port Moresby, and one specimen from Hollandia (?), three specimens of *picata* from north Queensland. Specimens previously studied include American Museum and Archbold material from Weyland Mountains, a large series of *D. t. kataui*, and several *melampus*.

It now appears that the specimens from the Weyland Mountains, formerly referred by me to *D. t. trivirgata*, are better considered as *D. t. arfakensis*. Although both *trivirgata* and *arfakensis* have the hands white, the black chin patch is undivided in the latter and in the Weyland Mountains series. In the type of *trivirgata* from the Aru Islands the black chin patch is divided longitudinally by a broad white line.

Dactylopsila trivirgata infumata,
new subspecies

Type: A.M.N.H. No. 107203, adult male; Lake Barrine, near Cairns, Queensland, 2400 feet; collected by Gabriele Neuhäuser, December 12, 1937. The type, a skin with skull in good condition.

General Characters: A much darker race of *D. trivirgata* than *D. t. picata*, with the pale lines of the back greatly narrowed by the broadened dark areas, the blackish mark of the chin divided by a narrow pale line running from the throat to the middle of the lower lip (duplicated only in typical *trivirgata* from Aru Islands); the hands and feet white, the underside of the tail, excluding the buff-colored tip, blackish brown, washed with buffy.

Description of the Type: The dark, lined areas of head, back, and limbs are blackish brown, less intensely black than in *D. t. picata*, the pale stripes grayish buff, not white as *picata* and not continued onto the tail (in true *picata* the buffy white sides and underside of the tail are continuous with the white dorsal stripes). The underparts are cream buff, the hairs of the median area self-colored along a width of 10 mm., wider at the chest and inguinal area and extending down the insides of the arms and legs. On either side of that median area the ventral pelage has gray bases and buff tips which combine to give a light buffy gray effect. In true *picata*, on the contrary, the area of self-colored hairs may be 30 mm. in width and the margining gray band hairs have much larger and whiter tips. The hairs of the metacarpal and metatarsal areas are white as in typical *trivirgata*, not blackish as in *picata*.

The skull appears similar to skulls of *D. t. picata* except in one small character which may not prove to be constant: the form of m^4. In the new race the posterior half of m^4 is wider proportionately than in *picata*, *kataui*, or *melampus*, giving it a subrectangular instead of a subtriangular outline.

Measurements of the Type: Length of head and body, 273 mm.[1]; tail, 347[1]; hind foot (s. u.), 46[1]; width of pale dorsal line at shoulders, 5 mm. (±10 mm. in *picata*); skull, condylobasal length, 55.5; zygomatic width, 42.3; mastoid width, 33.6; length of nasals, 19.5; least intertemporal width, 8.9; depth of zygoma behind postorbital process, 5.0; teeth, p^4–m^4, 14.4; crown dimensions of p^4, 2.5 by 2.0; of m^1, 3.9 by 3.3; width of anterior loph of m^4, 2.2; of posterior loph, 1.9 (in *picata* 2.1, 1.6, respectively).

Remarks: A second specimen of this smoky-colored striped phalanger, A.M. N.H. No. 107204, from Evelyn near Lake Barrine, was collected by Miss Neuhäuser. Unfortunately it has no skull. The skin is colored almost precisely like the type; the white chin stripe is even wider. For comparison three typical individuals of *picata*, two from Coen, one from Rocky Scrub, are available. These agree with Thomas's description (1908) and with Troughton's plate (1941). *Dactylopsila t. infumata* appears to be as closely related to the Aru Islands *trivirgata* as *picata* is to *kataui*.

Dactylonax palpator (Milne Edwards)

Dactylopsila palpator Milne Edwards, 1888, Mem. Soc. Philom., Centenaire, Paris, pp. 173–177.

Since writing my notes on *Dactylonax* (Tate and Archbold, 1937) I have had the privilege of examining the following material in European museums: the type of *D. palpator* (Paris Nos. 188, 257c, collected by Laglaize); Berlin No. A22,01, Aroa River; five specimens taken by Stein in the Weyland Mountains; and the type of *D. p. ernstmayri* (Berlin No. 42418, from Jungsaing, Huon Peninsula). The 1938 Archbold New Guinea Expedition obtained seven specimens of *Dactylonax* near Lake Habbema and two south of the Idenburg River.

The Archbold series from Lake Habbema, 2200-2800 meters, consists of four adult males, two adult females, and one juvenal (pouch?) female; that from south of the Idenburg River, 850–1200 meters, of two adult males. The tails of the former are much more densely haired than those of the latter, the width of the caudal pelage being $2^1/_2$ inches in the former, $1^1/_2$ inches in the latter. The Idenburg specimens match the Stein series from Weyland Mountains, ±6000 feet. The caudal pelage of the juvenal specimen is closely appressed to the tail instead of being erect and spreading as in adults. A sex character is perceived in the zygoma; its depth just behind the postorbital process in the males is from 5.5 to 7 mm., depending upon the degree of maturity, in the females from 4.8 to 5.3.

The minute middle upper premolar, usually present in *Dactylopsila*, is a fluctuating character in *Dactylonax*. It is present on both sides in five males and one female, absent on both sides in one male and one female.

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[1] Made in the flesh.

The number of minute lower teeth between the large incisor and p_4 is five in one male, four in all the other specimens.

The juvenal (A.M.N.H. No. 109415) has the flat-crowned i^2, the smallest of the three upper incisors in the adult state, fully erupted. The canine is partly functional, and the minute p^3 is fully in place. The teeth that are partly through are i^1, i^3, p^2, p^4, and m^1. In the mandible, i_1 and p_4 are partly functional. The four tiny intervening teeth, fully functional and polished, are probably used to hold the mamma. The first two lower molars are just showing behind p_4. Both upper and lower milk premolars have already been shed.

Elongation of the fourth anterior digit of the juvenal is fully as complete proportionally as in the adults. This is obvious if comparison is made with a juvenal *Dactylopsila*. The two basal phalanges (excluding the claw-bearing phalanx) measure together 14 mm. in *Dactylonax*, 11.5 in *Dactylopsila*. The basal phalanx of the same digit shows even greater contrast, 8.2:6.2 mm.

In the two juvenals of *Dactylonax* and *Dactylopsila* the color pattern shows essential differences. In the former the paired white dorsal lines terminate at the rump, their margining black areas converging at the tail to make the tail wholly black, above and below, except its white tip. In *Dactylopsila* the paired white dorsal lines are continued onto the sides of the tail to within about an inch of its black tip. These two lines are separated dorsally and ventrally by black lines. The dorsal black line is a continuation of the median dorsal black line and is merged distally with the black tail tip. The ventral line begins very narrow, 1 inch behind the vent and, gradually broadening, also joins the black terminal area of the tail. The ventral surface of the extreme tip of the tail appears not to be prehensile in *Dactylonax*. In all species of *Dactylopsila* except *D. megalura* the tactile area is perfectly obvious.

The white ring around the wrist in *D. p. ernstmayri* is not important. One of our Habbema specimens has the entire lower leg white.

Gymnobelideus leadbeateri M'Coy

Gymnobelideus leadbeateri M'Coy, 1867, Ann. Mag. Nat. Hist., ser. 3, vol. 20, p. 287.

Originally from the Bass River, Victoria. The little that is known about this probably extinct species was well discussed by Brazenor (1933). The generic name is not suitable; Brazenor states that there are no flying membranes.

GENUS PETAURUS

Petaurus Shaw and Nodder, 1791, The naturalist's miscellany, vol. 2, pl. 60.

Three species are currently placed in *Petaurus: P. australis*, the large, broad-headed *Petaurus* or "Yellow-bellied Possum-Glider" (Troughton, 1941), *P. norfolcensis*, the apparently rare, medium-sized "squirrel-glider," and *P. breviceps*, the small, rather common "sugar-glider." To the last the Australian forms *longicaudatus* and *ariel* and all the flying phalangers described from New Guinea and its outlier islands appear to be subspecifically related. *Petaurus norfolcensis* and *P. breviceps* are much more closely related than either is to *P. australis;* perhaps their differences are also only subspecific.

Aside from differences of size and the not very easily appreciable differences in the external characters of these flying phalangers, certain absolute characters perceivable in the skulls are shown in table 1.

Petaurus australis

Petaurus australis is sharply differentiated from all other species of *Petaurus* by the great breadth of the palate; the unusually great outer width across the canines is approximately equal to the length p^4–m^4, and the outer width across m^{1-1} exceeds it substantially. The back of the skull is correspondingly wide. The paroccipital processes descend almost twice as far as do the rather well-inflated alisphenoid bullae. The audital meatus is much shorter (from the bulla to the opening of the tube) than in either *P. norfolcensis* or *P. breviceps*. Of the teeth, p^3_3 are less reduced, and the molars are broad and massive. The coronoid process of the mandible seen from the side is broad and somewhat hooked compared with the narrow, unhooked, almost pointed coronoid in *norfolcensis* and *breviceps*.

Petaurus australis australis
Shaw and Nodder

Petaurus australis SHAW AND NODDER, 1791, The naturalist's miscellany, vol. 2, pl. 60.

Typical *P. australis* is shown by Iredale and Troughton (1934) to have come from Sydney, New South Wales. Troughton (1941) gives the range as from southern Victoria to southern Queensland, eastern Australia. The American Museum collections include no specimens referable with certainty to this race. Strangely enough the late H. C. Raven, although he obtained a fine series of both northern and southern *Schoinobates*, failed to secure a single specimen of *Petaurus australis*.

Petaurus australis reginae Thomas

Petaurus australis reginae THOMAS, 1923, Ann. Mag. Nat. Hist., ser. 9, vol. 11, p. 249.

Six specimens of this northern Queensland race of the yellow-bellied flying phalanger were assembled by Miss Gabriele Neuhäuser from Mount Spurgeon, northeast of Coen, Queensland.

Petaurus norfolcensis

This rare "flying-squirrel" is represented in the American Museum of Natural History by only three specimens, formerly on exhibition, from which the skulls have lately been removed and cleaned. They differ from *P. australis* by the characters already mentioned, but from *P. breviceps* their differences, other than those of size and the length and fullness of the tail, are less appreciable. The principal feature of anatomy by which they can be distinguished from *breviceps* is the proportionately smaller degree of reduction of p_4 and the greater degree of inflation of the bullae. The close similarity of the proportions of the skulls and teeth of these flying phalangers to those of *P. breviceps* and the marked and important differences from those of *P. australis* and its northern race *reginae* can scarcely be overemphasized.

TABLE 1

	P. australis	*P. norfolcensis*	*P. breviceps*
Mastoid width Zygomatic width	± 76	80–85	± 85
$\frac{\text{Depth of paroccipital process}}{\text{Depth of bulla}}$	±108	±97	±100
Length of meatus Zygomatic breadth	± 13	±20	± 17
$\frac{\text{Outer width across } c\text{–}c}{\text{Length } p^4\text{–}m^4}$	±107	±78	± 85
$\frac{\text{Width } m^1}{\text{Outer width } m^{1-1}}$	± 45	±20	± 20
$\frac{\text{Length crown } p^3}{\text{Length } p^4\text{–}m^4}$	± 19	±14	± 12
$\frac{\text{Length crown } p^3}{\text{Length crown } p^4}$	± 79	±76	± 67
$\frac{\text{Length crown } p_3}{\text{Length crown } p_4}$	±100	±70	± 55

Petaurus norfolcensis norfolcensis
(Kerr)

Sciurus (Petaurus) norfolcensis KERR, 1792, Animal kingdom...of Linnaeus, pt. 1, p. 270.

The type locality of *norfolcensis*, according to Iredale and Troughton (1934), is Sydney, New South Wales, not Norfolk

Island. Its range, Troughton (1941) signifies, includes Victoria, New South Wales, and at least southern Queensland. In northern Queensland the race *P. n. gracilis* replaces it.

We have no specimens of this southern race in the collections of the American Museum of Natural History.

Petaurus norfolcensis gracilis De Vis

Petaurus norfolcensis gracilis DE VIS, 1883, Proc. Linnean Soc. New South Wales, vol. 7, p. 619.

The type locality of this form is "north of Cardwell," northern Queensland.

In the American Museum of Natural History are two very faded specimens of this animal, withdrawn from exhibition, which are labeled Rockhampton, Dawson River. A third specimen, without exact locality, remains undetermined for geographical race. The skulls of all three have recently been taken out of the skins and cleaned.

Petaurus breviceps

Since *P. breviceps*, the smallest of the flying phalangers except the tiny *Acrobates*, was described in 1839, several additional forms have been made known in Australia and New Guinea. My present study of the species of *Petaurus* makes me feel reasonably certain that all of these are very closely related to *breviceps;* it demonstrates that *breviceps* alone of the three species of *Petaurus* has reached New Guinea.

The named forms of *breviceps* and their type localities and ranges, so far as ascertained, are:

NAME	TYPE LOCALITY	RANGE
breviceps = *notatus*	New South Wales and Victoria	Southeastern Australia
longicaudatus	Mapoon Mission, Gulf of Carpenteria	Northern Queensland
ariel	Port Essington	Northern Territory, Australia
flavidus	Oriomo River	South New Guinea
papuanus	Huon Gulf	Forested New Guinea lowlands, and New Britain, etc.
tafa	Mt. Tafa, 2000 meters	Central mountain system of New Guinea
biacensis	Biak Island	?

Besides occurring about everywhere on the mainland of New Guinea between sea level and 6000 feet, the short-headed flying phalangers are present on many outlying islands, including New Britain, Goodenough, Aru, Kei, Halmahera. Jentink records specimens from Soek and Mafool in the Geelvink Bay (possibly equal to *biacensis* from Biak), and from Misol, Bachian, Gilolo and Ternate.

Petaurus breviceps breviceps
Waterhouse

Petaurus breviceps WATERHOUSE, 1839, Proc. Zool. Soc. London, (for 1838), p. 152.

Petaurus (*Belideus*) *notatus* PETERS, 1859, Monatsber. Akad. Wiss. Berlin, p. 14.

Unfortunately the American Museum of Natural History still lacks material referable to this southern flying phalanger. I have examined and measured the skin of the type (there is no skull), B.M. No. 55.12.24.78, and the skull of another specimen from Paramatta, New South Wales, B.M. No. 10.7.16.6, male. The type is a short-tailed animal (125 mm.), its hind foot measuring 26 mm. (c. u., 28 mm.). The skull is generally larger than those of either the type of *papuanus*, or of *flavidus* or *ariel*.

Concerning the type skin my notes are: "specimen dirty. Dorsal stripe faintly visible, slightly more distinct on head. Body color darker gray than in *ariel*. Underparts dirty white with gray bases. Tail smoky gray, its distal 40 mm. fuscous. Hands and feet dark gray. The skull is reputed to be no. 361 of the collection in the Zoological Society of London."

Petaurus breviceps longicaudatus
Longman

Petaurus breviceps longicaudatus LONGMAN, 1924, Mem. Queensland Mus., vol. 8, abstr., p. ix.

This form is established by such a brief description that it barely passes the requirements of the International Commission on Zoological Nomenclature. I have examined two of Longman's cotypes, preserved in alcohol, at Brisbane. No skulls had been cleaned. They were numbered 4291, male, and 4292, female. The head and body measured 153 mm. and 115 mm., respectively, the tails 187 and 190. The hind foot of the male was 24 mm. This race is thus distinctly longer-tailed than either *papuanus* or *breviceps*.

We have in New York a short series from several parts of northern Queensland collected by Miss Gabriele Neuhäuser. Several have the tail even longer than Longman's cotypes, in others it measures ±160 mm., or even as short as in *flavidus* or *ariel*, though not so short as in the type specimen of *breviceps*. Moreover, the tails are much more heavily haired than in *flavidus*, and all three of our specimens from the region west of Coen differ by having the tip of the tail colored perfectly white beyond the place where the basal gray gives place to fuscous. Whether our material from near Coen and from Rocky Scrub and Somerset farther north can be truly referred to *longicaudatus* is still problematical.

Petaurus breviceps ariel (Gould)

Belideus ariel Gould, 1842, Proc. Zool. Soc. London, p. 11.

The type specimen of this form, B.M. 42.5.26.1, an adult female from Port Essington, Northern Territory, has been examined. Other material from the Northern Territory seen includes three specimens from the South Alligator River and one from Katherine River (all at Tring Museum).

The dorsal color of the type is light gray, almost devoid of the yellow-brown wash often seen in *flavidus* of south New Guinea. The underparts are pale self-colored buff. The pouch hairs are russet. The middle one of the three upper premolars is peg-like and single-rooted. The crowns of the third and fourth minute lower teeth between the large lower incisor and p_4 are also much reduced—to 0.3 or 0.35 mm. in length.

Petaurus breviceps papuanus Thomas

Petaurus breviceps var. *papuanus* Thomas, 1888, Catalogue...Marsupialia and Monotremata, p. 158.

Petaurus (*Petaurella*) *papuanus papuanus* Tate and Archbold, 1937, Bull. Amer. Mus. Nat. Hist., vol. 73, p. 387.

In addition to our records given in 1937, several specimens referable to this lowlands race, collected by L. A. Willis, have been received from near the mouth of the Kemp Welch River, Papua.

The provisional assumption is made on the basis of incomplete data that the flying phalangers of the southeast coast of New Guinea are equal systematically to those of the northeast coast (true *papuanus*). This may be true for the whole of the New Guinea lowlands that receive heavy rainfall during most of the year. As pointed out under *P. b. flavidus* the yellowish color of the flying phalangers of the monsoon grass country may be seasonally induced.

Petaurus breviceps flavidus
Tate and Archbold

Petaurus (*Petaurella*) *papuanus flavidus* Tate and Archbold, 1935, Amer. Mus. Novitates, no. 810, p. 25; 1937, Bull. Amer. Mus. Nat. Hist., vol. 73, p. 387.

Since the original series from the Oriomo River was reported, a second series of 20 specimens from the neighborhood of the Wassi Kussa, on the south coast of New Guinea, has been obtained. These skins merely confirm previous conclusions that the majority of the individuals are marked with yellow brown above and have buffy white underparts. A few, however, are grayer.

It seems probable that material from the Aru Islands (recorded by Jentink), which were probably connected with south New Guinea during the last glacial period, should be referred to *flavidus*. It is an interesting fact that the few specimens obtained by the Archbold Expeditions in the extensive low-altitude grasslands near Hollandia, the Cyclops Mountains, and Lake Sentani, all near the north coast of New Guinea and totally cut off from the south New Guinea grasslands, are also washed with pale brownish and have buffy underparts. This condition may then be somatic, the result of exposure to intense sunlight or some other environmental factor. The material from the northern area mentioned, though indistinguishable from *flavidus* on the basis of color above, is all longer-tailed and to that extent is more in agreement with *papuanus* of the Huon area, New Britain, and the D'Entrecasteaux Islands. I question whether these animals are sufficiently distinct to merit a subspecific name. In any case, Ulmer's *biacensis*, based upon a single skin without skull, may be available for them.

Petaurus breviceps tafa Tate and Archbold

Petaurus (Petaurella) papuanus tafa Tate and Archbold, 1935, Amer. Mus. Novitates, no. 810, p. 1; 1937, Bull. Amer. Mus. Nat. Hist., vol. 73, p. 387.

Additional material representing this dark-colored mountain race was obtained by me at Kagi, 5000 feet, on the trail from Port Moresby to Kokoda; Kagi is on the south slope of the Owen Stanley Range. No specimens were taken by Richardson in the Balim Valley near Mount Wilhelmina. In western New Guinea Stein took *Petaurus* only in the lowlands, while Shaw Mayer's specimens from the Weyland Mountains, reported by Rothschild and Dollman without altitude, may also have been lowlands specimens. Evidence is still needed to show that the smoky-hued mountain form occurs at all in Netherlands New Guinea.

Genus **Acrobates**

Acrobates Desmarest, 1818, Nouv. Dict. d'Hist. Nat., nouv. ed., vol. 25, p. 405.

Troughton (1941) follows the example of Jones (1923) in inserting *Cercartetus* (= *Dromicia*) and *Gymnobelideus*, both of which lack flying membranes, between *Acrobates* and *Petaurus*. All are shown by the form of their molar teeth to be phalangerine, not phascolarctine marsupials. Jones places *Acrobates* next to *Distoechurus* of New Guinea, which also has the caudal pelage markedly distichous. I have already pointed out (Tate and Archbold, 1937) that *Acrobates* is not a very close relative of *Distoechurus*, but differs by certain characters of its premolar dentition. Later I had the opportunity to examine and remark upon types or topotypes of all *Acrobates* (Tate, 1938).

From the fact that in *Acrobates* the last molar is obsolete, it follows that this genus cannot be directly ancestral to *Petaurus*. Other specializations in *Acrobates* include the subequal sizes of p^2 and p^4 (in most phalangerines p^4 is much the larger, but in *Distoechurus* p^4 is extremely small); the only slightly inflated mastoid bulla; the very large posterior palatal openings; the greatly broadened interorbital region (incipient in *Petaurus australis*).

The relative narrowness of the gliding membrane of *Acrobates* is not necessarily a mark of incomplete development; it may be correlated instead with the small size and insignificant weight of the animals.

Distoechurus pennatus Peters

Distoechurus pennatus Peters, 1874, Ann. Mus. Civ. Genova, ser. 1, vol. 6, p. 303.

Two additional specimens of the feather-tailed mouse possum have rather recently been added to the Archbold collection: a female from Kurasimari, Sepik River, 2000 feet, December, 1929; and a second female from Sturt Island, Fly River, western Papua, 50 feet, October, 1936. The former is referable to the race *neuhäussi*, the latter to *dryas*.

The Fly River specimen was interesting for the reproductive condition noted: a single mamma in the forward-opening pouch, placed medially, and a single pouch juvenal. The central position is analogous to the centrally placed nipples in the South American didelphids *Marmosa* and *Monodelphis;* the absence of paired mammae may be either fortuitous or constant.

The following is quoted from my notes on the same specimen: "Ears small and naked; the interior of the conch bearing tufts of long, very soft hair which projects laterally. The single juvenal was carried in the pouch parallel with the mother's body. The mammary gland converged upon the single median teat placed at the bottom of the pouch near the pubic arch. The epipubic bones seem to be absent. Only 5 mm. of the tip of the tail are prehensile. No trace of flying membranes. Eyes large, probably luminous at night. The young, with the head very large, becoming downy on head and neck; the tail and the hind feet near the fifth metatarsal pigmented. Length of head and body of pouch young, 45 mm."

The lack of genera closely related to *Distoechurus* has been indicated earlier in this paper.

Subfamily **Phascolarctinae**

GENUS SCHOINOBATES

Didelphis volans KERR, 1792, The animal kingdom...of Linnaeus, pt. 1, p. 199.

Schoinobates LESSON, 1842, Nouveau tableau du règne animal, p. 190.

Petauroides THOMAS, 1888, Catalogue... Marsupialia and Monotremata, p. 163.

The American Museum collection now contains two forms of *Schoinobates*, the phascolarctine flying phalangers, currently known as *S. v. volans* and *S. v. minor*. Of the former we have 10 specimens collected by the late H. C. Raven in New South Wales, of the latter 23 taken by the same collector on Atherton Tableland, northern Queensland, and seven by Miss Gabriele Neuhäuser at various stations in northern Queensland (Evelyn, Dimboola, and Mount Spurgeon). There are two more recorded races of these mammals, *S. v. armillatus* from "southern mid-Queensland" (Iredale and Troughton, 1934), and *S. v. incanus* from "South-eastern Queensland."

The skulls of *minor* and of true *volans* differ from each other to a greater degree than do the skulls of *Pseudocheirus peregrinus* and *laniginosus* which I recently (Tate, 1945b) united as subspecies of a single species. The geographical analogy between the distributional patterns of *S. volans* and *P. peregrinus* is also close. It is therefore preferable at this time to retain the conspecific status of *volans* and *minor*, while pointing out their distinctive characters.

From *S. v. volans*, *S. v. minor* differs sharply by its much smaller size including the toothrows (m^{1-4}, 12.2/14.2 mm.; width of m^1, 2.6/2.9); by the lack of a pronounced groove on the inferior surface of the bulla exteroposteriorly from the eustachian opening; by its relatively larger, more slender paroccipital processes; by the much less massive posterior margin of the palate; and by the truncation of the nasal bones posteriorly. In the mandibles the lighter weight of the teeth is similarly marked (the length of the crown of p_4, 2.2/2.9).

The skins of the two races differ chiefly by the ashy gray body color, brownish limbs and ears, and pure white underparts of *minor* in contrast to the blackish brown body color, tipped with pale gray, blackish limbs and ears, and partly gray-based white ventral hairs in *volans*. In two specimens of *S. v. volans* taken by Raven at Ebor, New South Wales, the backs and bases of the ears are white instead of smoky, the white extending to, and confluent with, the white of the throat. There is no indication of such white areas in the account and plate of the "Black Flying Opossum," published by Governor Phillips, from which Kerr's (1792) technical description was taken.

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